AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

Reg. U. S. Pat. Off.

Vol. 66 No. 11

NORMAN G. SHIDLE, Directing Editor

LESLIE PEAT, Managing Editor
P. M. HELDT, Engineering Editor
JOSEPH GESCHELIN, Eng. Editor
ATHEL F. DENHAM, Field Editor
JEROME H. FARRIS, Asst. Editor
HERBERT HOSKING, News Editor
GEOFFREY GRIER, Art Editor
A. B. CROFOOT, N. Y. News Rep.

Contents

Machine Tool Makers Can Jump in As Consultants to the Industry. By Athel F. Denham.. 409

McCarty, With Nash 10 Years, Heads Strong Executive Group. By Norman G. Shidle... 414

Amo and Nizhni-Novgorod Plants Lead Soviet Vehicle Plans. By Walter L. Carver..... 418

Just Among Ourselves 423

Manufacturing Control and Service Experience Hold Key to Wheel Alignment. By Joseph Geschelin 424

Production Lines 429

Automotive Oddities 430

News of the Industry 431

Calendar of Coming Events 438

New Developments 440

Advertisers' Index 58-59

Automotive Industries is published every Saturday by
CHILTON CLASS JOURNAL COMPANY
Chestnut and 56th Streets, Philadelphia, Pa.

C. A. MUSSELMAN, President and General Manager
J. S. HILDRETH, Vice-Pres. and Director of Sales
W. I. RALPH, Vice-Pres. G. C. BUZBY, Vice-Pres.
A. H. VAUX, Secretary and Treasurer
JOHN A. CLEMENTS, Asst. Treasurer
JULIAN CHASE, Business Manager Automotive Industries
GEO. D. ROBERTS Advertising Manager
Cable Address .....Autoland, Philadelphia
Telephone .....Sherwood 1424

OFFICES

New York—U. P. C. Bldg., 239 W. 39th St., Phone Pennsylvania 6-0080
Chicago—367 West Adams St., Phone Randolph 9448
Detroit—710 Stephenson Bldg., Phone Madison 2090
Cleveland—1140 Guardian Bldg., Phone Main 6860
San Francisco—1045 Sansome St., Phone Douglas 4306
Los Angeles—Room 651, 1206 Maple Street, Phone Westmore 6477
Portland, Oregon—311 Pine Street

Controlled by United Business Publishers, Inc., 239 W. 39th St., New York; ANDREW C. PEARSON, Chairman, Board of Directors; FRITZ J. FRANK, President; C. A. MUSSELMAN, Vice-President; F. C. STEVENS, Treasurer.

SUBSCRIPTION RATES: United States, United States Possessions, $1.00 per year; Pan-American Union, $3.00 per year; Canada and Foreign, $4.00 per year. Single Copies 25c.

COPYRIGHT, 1932, CHILTON CLASS JOURNAL COMPANY

Member of the Audit Bureau of Circulations
Member Associated Business Papers, Inc.

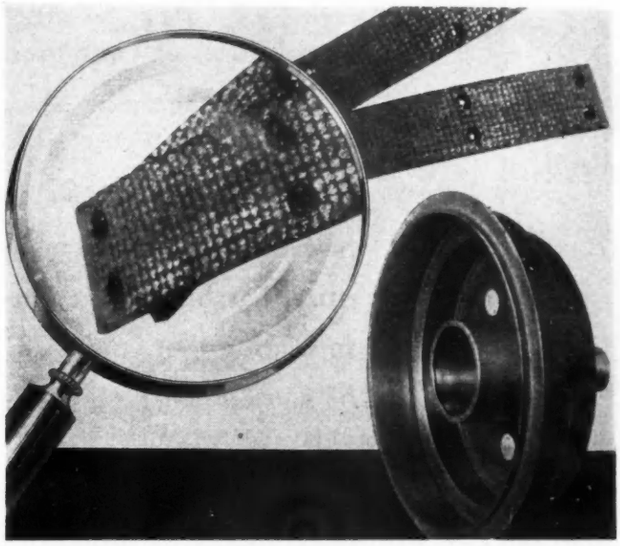
Automotive Industries—The Automobile is a consolidation of the Automobile (monthly) and the Motor Review (weekly), May, 1902; Dealer and Repairman (monthly), October, 1903; the Automobile Magazine (monthly), July, 1907, and the Horseless Age (weekly), founded in 1895, May, 1918.

45 TRIPS

down Ligonier Mountain

with no appreciable wear to lining or drums

● Forty-five times was Rusco Test Car No. ET5 started from the summit of Ligonier Mountain and allowed to free wheel the entire distance to the bottom. Yet, as the accompanying photographs show, there was no sign of the lining burning out, fading, charring or cracking. Nor were the drums (cast iron) scored to the slightest degree.



The procedure followed in this test was as follows: First, the car was loaded with 600 pounds of ballast in addition to the weight of the driver. Second, starting at the summit of the mountain, the car was accelerated to a speed of 40 miles an hour. Third, the car was put in free wheeling and held at 40 m.p.h. by constant application of the brakes. Fourth, upon completion of the 4½ mile run to the bottom and while the car was still traveling at 40 miles an hour or more, an emergency stop was made, severe enough to lock both rear wheels.

In addition to the absence of any signs of wear to lining or drums, the following data is of interest: The pedal pressure required to hold the car at the fixed speed of 40 m.p.h. was 30 lbs. The final stop was made at a deceleration of 15 to 18 ft. per second², and with a pedal pressure of 125 lbs.

Complete performance data on Rusco linings for your brake will be furnished gladly upon request. Address, Engineering Department C-2, The Russell Manufacturing Company, Middletown, Conn. Incorporated 1834.

RUSCO
MOLDED OR WOVEN
BRAKE LININGS

YOU ARE INVITED

to avail yourself of the research facilities of *Automotive Industries* for studying and extending the market possibilities of your product or service in the automotive manufacturing field.

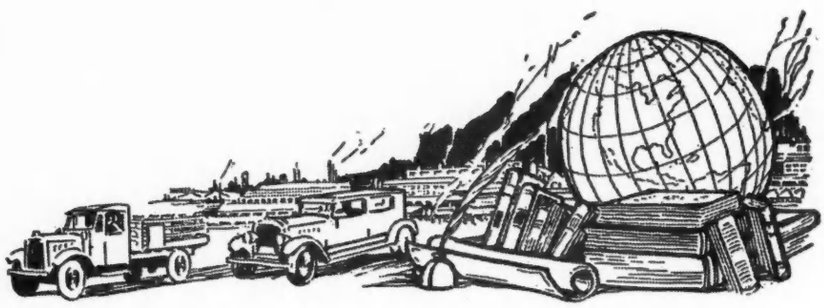
Automotive Industries' intimate contact with the many branches of this huge industry, since its very beginning, has built up a wealth of data and statistical information that is offered to those who are now or may be contemplating a cultivation of this field.

Address, entirely without obligation, the Business Department of ***Automotive Industries.***

AUTOMOTIVE INDUSTRIES

A Unit of United Business Publishers, Inc.

Chestnut and 56th Streets, Philadelphia



AUTOMOTIVE INDUSTRIES
VOLUME 66 — MARCH 12, 1932 — NUMBER 11

Machine Tool Makers Can Jump In As Consultants to the Industry

by Athel F. Denham

"He says he can't see you"

IF fifty per cent of the whole market for American motor vehicles were concentrated in Switzerland, it's safe to bet that American automobile manufacturers would be spending a lot of money to find out what the Swiss prime minister eats for breakfast, and how that would be likely to affect the policy of the country for years ahead. There would also be business of digging out who else in the country was important, what he was thinking about, etc., etc., and what he might do, in a moment of aberration which would affect the future course of this big slice of the motor-vehicle market. A lot of people would be paid only to gather information.

Right here in the United States more than 40 per cent of the machine tool market is found in the automotive industry, and the heart of the industry is located in a geographical area much smaller than that of Switzerland. One would assume that the machine tool industry would have a lot of people in Detroit whose job it would be to find out what the automotive industry is thinking, how far ahead it is thinking, and how new tools might be designed to make car parts which fall into line with that thinking.

That's the assumption, but the facts don't seem to bear it out. In spite of the fact that a lot of machine tools are built to meet a specific problem arising on the production lines of an individual vehicle manufacturer, a much greater proportion of machines is sold, so to speak, "over the counter," out of the warehouse, from a catalog. That's called normal distribution. It assumes

First, a desire on the part of a vehicle manufacturer to produce a given article;

Second, that he has no tools in his shop which his own production men can adapt to the job; or to which his engineers can adapt the article;

Third, that he makes his wants known to one or more machine-tool builders;

Fourth, that one of the tool builders can furnish a

A Prophetic Fable

Some day a machine tool salesman will get into gear with the thinking of motor vehicle manufacturers. He will become acquainted with engineers and sales executives alike; he will know numerous vice-presidents; he will call austere bankers by their initials; his voice over the telephone will be welcome to the industry

standard machine from stock, or build a special machine to meet the requirements of the vehicle manufacturer.

It puts the machine tool manufacturer in the position of sitting around and waiting for an order. After a long course of negotiations, a sale is finally made. What happens?

The machine tool salesman makes a note in his book: "Sold a turret lathe today to the Runwell Car Co., January 1, 1932. Normal depreciation period of the lathe 10 years, according to the Runwell accounting method." Then, if he is young and vigorous, the salesman makes a note to mention turret lathes again at the Runwell plant in 1942, or perhaps in 1938, in order to be a few years ahead of the rest of the boys. Normal distribution again.

A year or two ago the manufacturers of parts and sub-assemblies and accessories were selling to the automotive industry along the same lines. The vehicle engineers would get a design to the blueprint stage, then send it out for bids. Somebody would get a contract for a year's supply of transmissions. They'd spend the year feverishly manufacturing transmissions—to the vehicle maker's specifications. The engineering contributed would consist of sticking to design, tolerances, costs, and trying to make a profit out of the price which resulted from purely competitive bids. Generally speaking, each parts manufacturer hoed his own little garden patch, using what seeds were blown his way by the tempered wind.

That was 1929. Then the sales curve for vehicles banked, turned and went into a spin. Parts manufacturers frantically combed the market for orders. Costs were cut, personnel was cut. Sales effort produced more sweat than could be mentioned in polite society. Still no orders. Clearly the normal state of the market was all shot. Then some parts maker (through his engineers) discovered or bought the rights to an innovation.

Stepping up his sales thinking from low into high gear, he reasoned that if that gadget could be made at a price, it would sell cars. He convinced the vehicle makers that such was the case. It worked. Other parts makers and gadget makers saw the light, and behold in the year 1931 there was a fundamental revolution in the parts market for some smart companies. Ideas for parts that would sell cars were found, made and sold to the car makers by the parts makers.

The vehicle engineers were then selecting devices, instead of selecting the lowest bidder.

The car sales executives figured heavily in this situation. They wanted new devices which would sell cars in a tough market. They got them from the

parts makers who had seen the light. All this helped the machine-tool industry indirectly.

Tool makers who begin thinking now can have a similar fundamental part in designing the motor vehicles of 1933 and 1934, and as a corollary to this will sell many more machines to their biggest potential market. Twenty-five thousand machines a year are becoming obsolete, figuring on mechanical obsolescence alone. This obsolescence rate can be accelerated in proportion to the amount of specific planning for the automotive industry that the machine tool builders are willing to undertake. Obsolescence can be removed from the sterile vacuum of accounting, and made into a living force. The tool maker who designs a machine which will permit the vehicle manufacturer to do something new, as well as to do something better and cheaper, has forced the previous way of doing it into obsolescence, and the vehicle maker will welcome the chance to do some heavy writing-off of old equipment.

Machine tool builders must push their thinking far enough ahead so that it takes in building, or at least designing, machines to make automotive parts which the vehicle makers are only thinking of putting on their cars. Take one example. Independent springing of vehicles is a question which has been before the industry for many years. If one machine tool builder, or a number of them were to familiarize himself with current engineering thought on this subject, study the existing data on independent springing and design part or all of a production set-up for producing the necessary parts rapidly or economically, and then take the complete set-up to any of the vehicle manufacturers who are now studying the problem he would certainly be assured of a favorable hearing.

Instead of saying: "Here's a new machine or battery of machines I would like to sell you," the approach would be different and better. He could say: "Here are the designs for the production of independent springing components which you want and which will put your car way out in front of the industry when you adopt them. The cost will be so much per unit. Compare that with your present method of producing conventional spring parts. Maybe the cost is higher but look at the sales appeal. We know your set-up. Here's how the thing will fit into your production lines. We can start making the machines right away."

Then comes the question of advertising. Advertising is good in the sales policy which is based on the idea of "Here's what we have. Look how good it is. It will do this and that at such and such a cost." But advertising is even more powerful in the changed sales situation we are describing. What new resources of words can be brought to getting across to the automotive industry your new conception of service . . . . service that breaks away from the traditional idea of selling tools as so many units, and puts engineering assistance rendered ahead of the machine.

If the machine tool industry is to take full advantage of its future opportunities in the automotive industry, the time has come when sending machine tool "salesmen" to Detroit is an expensive waste of time. The program we are advancing calls for a type of man who may well be called an ambassador to the automotive industry. Like the diplomat he analogizes, he should be acceptable to the industry where he goes, in the sense that he should speak its language and have an intelligent and sympathetic interest in its problems. The chief problem in today's phase of the automotive industry is selling vehicles.

He will be ready to talk with factory executives about their problems. He will talk to them in their terms. He will have opinions about salient sales features—about gadgets, horsepower, riding comfort and irresistible appeal

When a political ambassador wants information about how a war is progressing he doesn't go out and interview sharpshooters on the firing line (sharpshooters are trained to work on one small target at a time); he calls the prime minister of the country to which he is accredited. Maybe some of the generals who are conducting the war will be retired before the day is over. It isn't so important how the war is progressing as how its progress satisfies the big boss.

He will interpret the needs of 1933 and 1934 in terms of his machine tools—and he will sell and sell and sell

Here again the analogy fits the machine tool sales situation. The representative of the machine tool builder should spend more time getting close to engineers and to sales and policy-making executives in the automotive industry. Within the past two years, the latter have taken a more and more important part in deciding what *engineering* ideas shall finally go into cars. Some of them couldn't figure the stresses in a fractured toothpick, but all of them are sensitive to bends in the sales curve. And any gentleman who steps into the arena with an Idea, based on the use of a new machine tool to produce a new component that will sell cars, is going to be a fair-haired lad indeed and he will be just as welcome to the engineers. The machine-tool "salesman" (new model) should be trained up to a comprehensive knowledge of vehicle engineering. He should be an avid student of the technical literature of motor vehicles, down to the last cotter pin and lock washer. He should, if necessary, write himself a book analyzing motor vehicles from the standpoint of what tools are now used (under various conditions of productive capacity in plants) for the output of each part. He should be in the vanguard of those who are thinking about the future design of automotive vehicles, and should report to his factory the kind of information which will enable it to design tools to meet the requirements of that future design. To do this he will have to know not only automotive engineers, but sales managers, secretaries, treasurers; and bulwarked with the acquaintance of a whole bushel of vice-presidents, get his stuff across to presidents and chairmen of the board. It may even help to know a couple of bankers.

Every one of the above types will have something to contribute to the machine tool salesman's knowledge of what kind of a car will sell. Then when the tool salesman, in conjunction with his company staff, has figured out a tool set-up to produce that kind of a car, the acceptance of the idea will be smoothed by taking it directly to the executives, after checking through with the engineers. The factory engineers will be called in, of course, and they will have plenty to say in the final selection of machine tools. This is as it should be. But when the first and paramount question is not only whether the tool set-up offered will produce economies in overhead, but rather whether it will produce something that will help to sell more cars, the financial and sales executives will be inclined to forgive minor mechanical deficiencies—and the executives' sign orders.

There are still a lot of engineers in the industry who frown when free wheeling is mentioned. But the sales managers who were instrumental in getting it adopted during the first flush of its novelty and sales appeal, smile. And it may be fairly assumed that the parts makers who are shipping large releases of free-wheeling units don't give a white horse's tail feather what the engineers think about it, except insofar as they are trying to make a particular free-wheeling unit more satisfactory from the mechanical side.

The automotive industry has entered a period of tremendous detailed mechanical development. New ideas for mechanical devices that will increase the sales appeal of cars are finding easier acceptance. The flow of automotive patents through Washington channels while (unfortunately) no faster so far as actual issuance is concerned shows more and more attention to motor vehicles on the part of inventors. Consulting engineers are being more extensively used for the development of specific phases of new vehicles. In other words, the factory engineer is seeking every bit of outside assistance that they can lay their hands upon. He is turning to his own staff of production engineers for assistance in quickly translating new, salable developments into finished units. In many cases lack of facilities for tooling it economically or efficiently has resulted in the rejection of a design for a new and otherwise practical device. It is, often, not only a case of being unable to use the existing tool set-up, but rather inability to conceive of or get another which will meet the requirements, or meet them fast enough. In other words, the machine tool has become the limiting factor in many phases of automotive design and development work, and the question "can we get a tool to make it cheaply?" or even, "can we get a tool to make it?" is the first question to be asked when the first experimental drawings see the light.

In no machine market where such a condition ex-

TOOLAPHORISMS

A machine tool is obsolete when the work it produces does not definitely contribute to increased sales of motor vehicles.

To the car sales manager, obsolescence of machine tools in this sense is something to welcome. The faster the better. Every time a new tool replaces an old one, he can be certain that something on the car he sells is better, cheaper, new.

Keep close to executives in vehicle and parts plants; but keep close to the engineers too, particularly when the engineers are also vice-presidents. In the well of automotive technical progress, the vehicle engineers are the shoring which keeps out quicksand.

The machine tool salesman should have not one catalog, but several, each one devoted to the solution of a specific production problem in the automotive industry. But his best "catalog" will be a list of automotive specialists employed by his company and what they have accomplished to help the vehicle manufacturers sell better and cheaper cars. It's better for a machine tool supplier to outguess his competitor than to outbid him, provided a new idea for incorporation into a motor vehicle is born.

THIS OPPORTUNITY BEGAN 2 YEARS AGO

We have just finished looking over the plans for an engine design of remarkable simplicity and broad possible applications. The design is virtually complete, the engine has been tested. A consulting industrial engineer has made a voluminous analysis of the manufacturing set-up relative to production of the first 10,000 units. Development work of three years is reaching its final fruition.

Here, we believe, is a type of opportunity which the active and intelligent machine-tool builder will seize upon. There are boundless opportunities for economical production of this engine, given the whole-hearted cooperation of an interested machine-tool builder. A careful canvass among the consulting engineers made two years ago would have dug out the fact that here was a potential outlet for machine-tool use opening up. The machine-tool salesman (new model) would have kept in touch with the progress of the engine design, and would have slipped in a word now and then on the engine when considered as a problem in tooling. He would have sought out the backers of the development and got across the story of how his machines would help out in the production of the engine, long before the components were assembled.

ists can there be said to exist a real depression. Such declining as has been noted is the result of misinterpretation of the needs of the market. The market is, potentially, bigger than it has been at any time since it was characterized by the springing-up of dozens of companies which had to have machines but couldn't always pay for them. Needless to say, besides its physical size, the present potential market for machine tools in the automotive industry is immeasurably sounder.

The future automotive market is one ground in which digging will produce pay dirt for machine tool builders. Here's another example of intelligent spading: Not long ago we were discussing with a manufacturer of worm gears his potential business in the automotive field. This manufacturer expressed the belief that worm gears for rear axles were past history in passenger automobiles. On the surface, this statement looked true. Fundamentally there was no reason why it should be so. The difference between the actual situation—virtually no worm gears were being used; and the possible situation—they would furnish one means of dropping the rear axle of a car and giving it a lower center of gravity—rested almost entirely on the lack of a machine tool for satisfactorily finishing worm gears. Then came the machine tool manufacturer who saw the lack, and the possibilities such a machine would open up. Another parts maker, not the first, saw the possibility too, and purchased a machine. The sequel. One of the old-established car makers who has made his own rear axles for years, accepted the worm-gear design of the parts maker—and it will take quite a few tools to produce his requirements.

Changes in the styling and mechanical make-up of motor vehicles are a matter of months, not years, but the fundamental thinking which finally results in these changes goes on years ahead. Both of these conditions favor whatever time and effort the machine-tool manufacturer may spend in doing development work for the automotive industry, with the reasonable expectancy of following this work with the sale of tools to make the work possible. There have undoubtedly been cases where a machine-tool builder spent time and money in the development of a machine designed specifically to do some job for the automotive industry, only to be disappointed in sales of this machine.

But such cases are often predicated upon taking the facilities of the industry as they now exist, and rearranging them. Such profitable development as is done must be far enough ahead of the present needs of the automotive industry to constitute a new and startling idea. It does not have to go to the stage of completing the manufacture of the actual machine tools needed to carry out the idea. A paper explanation is enough, provided the tool maker can guarantee delivery and installation of the completed set-up within a reasonable time. One solution of the problem, from the economic side, is for a group of machine-tool builders to employ a competent automotive engineer, to analyze the automotive industry purely from the point of view of what the industry is going to be making within the next five years (making to sell at a profit) and what tools will be needed to make it, with due regard for complete rearrangements of production processes. Assuming that no tool-builder makes all the machines that would be used in one motor vehicle factory, such an institutional effort would be of great benefit to each of the tool builders concerned.

It has been predicated before that car engineers are not willing to discuss with machine tool representatives their problems in such a way as to bring out helpful cooperation. It is our view that inability to reach this point has rested upon misunderstanding of what can be accomplished. The time for the tool-maker's sales talk is after the problem offered by the engineer has been studied carefully and as impartially as circum-

(Turn to page 422, please)

McCarty, With Nash 10 Years, Heads Strong Executive Group

Human engineering of "The Boss" finds able exponent in new president who began his automotive career with Studebaker before moving to Kenosha

by Norman G. Shidle

"EARL H. McCARTY is president of Nash!" That news, flashed through the industry and trade just at the opening of the New York automobile show, stood out as the most important trade news in a week crowded with announcements. The active management of one of the great companies of the industry had been placed in new hands. Charles W. Nash, founder of the Nash Motors Co. in 1917, had retired to the chairmanship of the board, passing to a younger man a large share of personal responsibility and leadership. The great personality which had fought its way from farm boy to industrial tycoon was announcing to the world his decision to place on another a good share of the task of carrying-on in the future.

Naturally the industry was interested. Dealers and distributors in and out of the Nash organization talked of and asked questions about this new Nash chief. The announcement came as a striking surprise to many who had not been intimately in touch with Nash operations.

But had one looked back over Nash history for a period of years, the ascendency of Earl H. McCarty to the presidency need not have come as any great surprise. As far back as 1925, Mr. McCarty had become a member of the board of directors of the company. And three years later, in 1928, when he was made vice-president and director of sales we find Mr. Nash saying of him:

"His splendid record of executive and administrative ability, his personality and untiring energy have earned the confidence and respect of us all."

Surely, then, there is little but the working out of logical expectancy in finding Mr. Nash, four year later, announcing the appointment of Mr. McCarty as president, along with the appointment of new vice-presidents and saying of the group:

"Strong men, and many of them are the essential factors in successful corporate operation. I am gratified that the directors have concurred in this Nash policy and in our choice of company officers; but I am even more gratified that the men who have been so long associated with me have proved themselves so positively."

As I read that statement of Mr. Nash's on the ninth day of January, 1932, I was carried back to another day in June, 1925, when I had journeyed to Kenosha to interview him. My mind went back particularly to one of the statements which he made at that time in

The executive group, greeting the first new Advanced 8 model to leave the production line, includes: Left to right—Harold Seaman, president of the Seaman Body Corp. and Nash director; James T. Wilson, vice-president; N. E. Wahlberg, vice-president in charge of engineering; H. E. Long, vice-president in charge of purchases; H. J. Mellum, secretary; Meade Moore, chief engineer of the Racine division; E. H. McCarty, president; Irving Seaman, secretary-treasurer, Seaman Body Corp.; D. M. Averill, manager Milwaukee division; C. H. Bliss, vice-president in charge of sales; Robert B. Elliott, vice-president in charge of operations, and Charles W. Nash, chairman of the board of the Nash Motors Co.

In winter Mr. McCarty (center of above Nash group) likes to bowl. The broad McCarty smile is a familiar sight on the Nash compound where the picture at the right was made

answer to my question, "What policies are responsible for building successes in automobile manufacturing?" That one statement was "Humanity—It all gets back to men in the end and often to one man in an organization. The spirit of the men at the top of the outfit is almost certain to be reflected throughout the rank and file. Results are obtained not so much by the policies which he enunciates as by the policies which he lives and acts."

I feel sure of this, because no one can talk to this new Nash president and not reflect on how completely he fits the requirements set up by that old Nash statement. The policies which he enunciates are not startling—but they are thoroughly sound. And a look through his past record, coupled to informal talks with the men who have worked for and with him, emphasizes the soundness and fairness of "the policies which he lives and acts."

Earl H. McCarty was born in New Carlisle, St. Joseph county, Indiana, on March 13, 1886. In this little town, at the northern end of the state, a few miles from the Michigan border, its population only a

Recent shifting of executive responsibilities at Nash has emphasized the strength and experience of the organization surrounding E. H. McCarty, as he takes over the presidency of the company.

C. H. Bliss, vice-president and director of sales, has just been elected to the board of directors of the company.

James T. Wilson, vice-president in charge of manufacturing, has been associated with Charles W. Nash ever since carriage-making days.

N. E. Wahlberg, vice-president in charge of engineering, designer of the newly announced Nash 1932 line, is another whose association with Mr. Nash dates back many years.

Robert B. Elliot, vice-president in charge of operations, was advanced to his present post at the time Mr. McCarty became president.

Harold E. Long, vice-president in charge of purchases, also assumed his present title at the time of Mr. McCarty's advancement.

* * * *

And behind the whole group, as chairman of the board, remains "The Boss," Charles W. Nash, genial, sturdy and forceful——sixty-eight years young!

few hundred, he spent the early years of his life and got his schooling.

Moving to South Bend, some 15 miles away, he got his first job while still in his 'teens, going to work for Studebaker Bros. Mfg. Co., then the leading carriage and wagon building company of the Middle West. This was back in the days when Clement Studebaker, one of the original founders of the old H. & C. Studebaker, had just died and been succeeded in the presidency by his brother J. M. Already Studebaker had been experimenting for several years with one of those "horseless carriages," about which considerable was beginning to be heard.

The youthful McCarty knew little of "horseless carriages" at that early age. He was concerned with fulfilling the demands made upon him as an eager young clerk in the billing department. That he did this was indicated by his gradual advancement to a position as a salesman in the carriage division.

He became manager of the horse-drawn vehicle branch at Portland, Oregon, and later manager of a larger horse-drawn vehicle branch at Dallas, Texas.

By this time, the "horseless carriage" had become an "automobile" and was beginning to contend seriously with the horse-drawn vehicle as a means of individual transportation. And McCarty continued to move with the times.

He was transferred to the automobile division of Studebaker and returned to Portland as manager of the automobile branch.

Then he was called back to the factory to become assistant sales manager.

A contact with Charles W. Nash, shortly after the Chicago automobile show in 1922, resulted in his leaving South Bend and joining the lusty young Nash company as sales manager. Already familiar with all phases of automobile merchandising, his success continued in the Nash organization with his appointment as vice-president in charge of sales in 1927.

A year or so later, he tried to retire from active business and succeeded to the extent of resigning his position, going to live on the Pacific Coast and enjoying a life of ease for a little over a year. Early in 1930, however, the urgency of the Nash call again became too great and he returned to Kenosha and the Nash organization—this time as vice-president and general manager.

When we hastened to Kenosha last month, eager to be the first to interview Mr. McCarty as Nash president, we found him ready and willing to talk about dealers, merchandising policies, new models, future engineering trends, the men in his organization—in fact almost anything connected with the automotive industry. We say "almost anything" because on just one subject we found him wholly uncommunicative —himself. He seems to be strong on action—and weak on reminiscence. He seems to be interested in past events chiefly as guides to future movement. One's first impression of him is of a man with abounding health, clear eyes and vigorous mind. He has the body of a well-trained athlete, the brain of an executive of the highest type. Yet there is about him nothing of the go-getter. He is comfortable to talk with; relaxed in his personal relationships.

The dealer organization is much on his mind. "No factory can afford to hold on to policies which hinder dealers from making a profit," he said shortly after he started to talk. "Take this matter of service," he went on. "We urge our dealers to service all makes of cars in every case where local conditions indicate that such general service work will be profitable. We believe that such a practice frequently enables the dealer to put his repair work on a profitable basis and to keep a better relationship between overhead and income.

"We're not entirely unselfish in this, of course, because we believe, too, that service contacts of this kind are very definite aids to the development of new car prospects. If the owner of a competitive make of car gets in the habit of coming to a Nash dealer for service, that Nash dealer has a better chance to sell him a new car when he gets in the market."

When I suggested that this attitude toward servicing all makes of cars was unusual on the part of factories, Mr. McCarty expressed surprise. "Leaving aside the advantages to dealers in given instances," he said, "it seems to me that there is a very definite sales advantage for the factory in every case."

His attitude toward overhead expenses in dealer establishments is extremely practical in light of existing conditions. "Out here at Nash we have never tried to force distributors or dealers into flashy, expensive showrooms. We would far rather have our dealers making a profit for themselves than a temporary showing for us.

"Sometimes that means that the dealer should have a side-street location. If such a location actually gives him a better chance to make money, we're for it. We want dealers who are permanent—and they can't be permanent if they sink all their money in expensive locations simply to try to look important for the time being.

"In several cases we have definitely opposed expansion by important distributors and dealers when we felt they might be loading themselves with more overhead than they could carry. The day of the expensive location and overhead setup is past for average automobile dealers. More sales effort and less sales showroom may be the order for the successful retailers in the future."

Earl McCarty doesn't talk about being honest and fair and square. Those are the things that he takes for granted—like living and eating and breathing. But his ideas exemplify those qualities in every expression of opinion one elicits from him. He seems to believe in the old fashioned virtues so strongly that it never occurs to him to talk about them.

His genius for organization, men down through the Nash organization will tell you, lies in his ability to get other people working with him. "He never asks you to do anything he wouldn't do himself" was the way one man put it—a man who has worked with and for McCarty over a long period of years.

This quality of leadership through friendliness and fairness was illustrated by a talk which he made more than a year ago to a group of factory foremen on the occasion of his return to the company as general manager. No stenotype notes of that talk were made, but—facing a crowd of manufacturing men who, deep in their hearts, undoubtedly were daring this sales-trained executive to come in and tell them how to do things—he said something like this:

"I know very little about your manufacturing end of this business. I'm going to learn all that I can. But I've got to depend entirely on you men both to do this job in the fine, effective fashion you've always done it and at the same time help to teach me something about how and why you do various things.

"The manufacturing job is up to you now as it never was before. And I'll certainly appreciate everything you can teach me!"

Mr. McCarty is pleasant, cordial in his personal relationships both inside and outside the factory. He is very direct, often blunt in his statements, going directly to the point of a discussion. He is noted for saying directly to every man's face anything that he might say were that man not present. "You always know exactly where you stand with Mac," his associates at the factory say.

As a natural concomitant of his frankness, he is consistent in his thinking and actions. He never says one thing and means another. He never says one thing and does another.

In summer Mr. McCarty turns to golf. The other member of the twosome is H. E. Long, Nash vice-president in charge of purchases

Outdoor Appeals

A love of exercise and the kind of companionship which goes with outdoor sports is one of his outstanding traits. He is a swimmer, an enthusiastic, but inexpert golfer, and plays tennis regularly. In the winter he likes to bowl and is a member of one of the regular teams in the Nash intra-factory bowling league, which is comprised of workers and executives from all departments of the company.

He has long been active in the work of the Young Men's Christian Association and at present is vice-president of the board of directors and chairman of the business committee of the Kenosha Y.M.C.A.

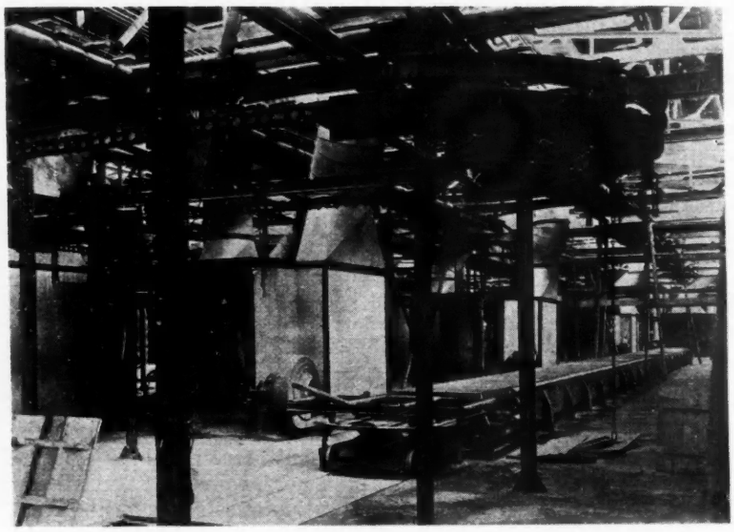
He is married and has four children, all boys. His oldest son works in the First National Bank of Kenosha and recently made the new Nash president a grandfather—which, as Knute Rockne used to say, is interesting, but not important. His second son attends Leland Stanford University, while his two younger boys are still in school in Kenosha.

Vigorous carrying out of those sound policies which have built Nash into one of the great motor car companies of the industry, rather than inauguration of different practices, is to be expected under Mr. McCarty's regime. That continued success is to be expected as a result, is indicated by the fact that these tried policies enabled Nash to produce a profit of $4,807,000 in 1931, the year of the most serious depression the automobile industry has known in many years.

Amo and Nizhni-Novgorod Plants Lead

by Walter L. Carver

Rapid transition from hand-made vehicles to plant incorporating latest American high-production machinery is most obvious development in Soviet progress toward supplying an immense area with all its automotive needs



Groups of baking ovens with conveyor to feed them are indicative of the progress in production methods in the Soviet

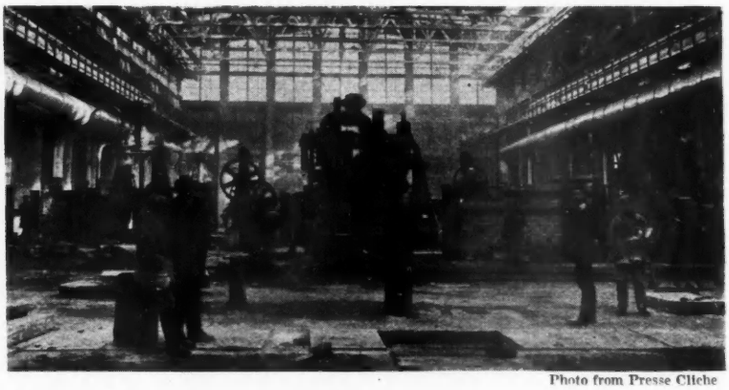


Photo from Presse Cliche

The new forge department at the Red Putilove Works, Leningrad

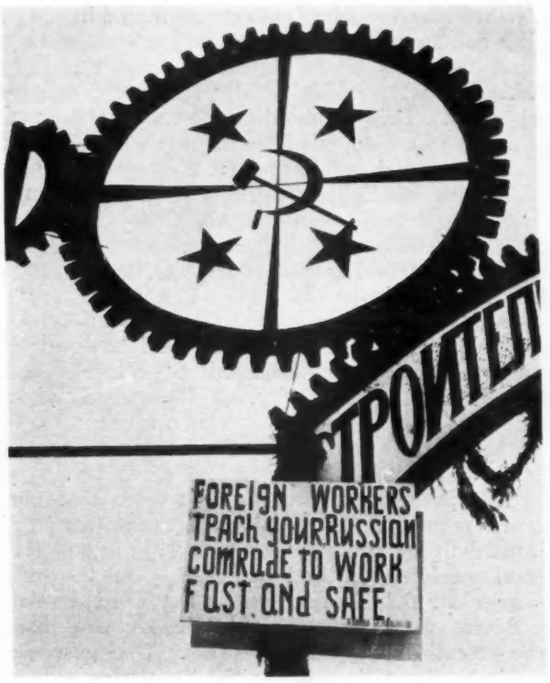
LARGELY as a result of the immense emphasis which has been placed upon tractor production, motor vehicle plans in the Soviet Union do not yet represent so striking a degree of accomplishment. Now that the channels of tractor production are pretty well laid down, as was demonstrated in last week's article,* it is to be expected that the next two or three years will witness equally forceful endeavor in the automobile field.

The most advanced motor vehicle project is the Amo truck plant in Moscow, which was opened in October after a two-year period of complete reconstruction and enlargement. When I first visited this plant in November, 1929, this reconstruction was in the early stages and was superimposed on the production of about 200 per month of a model which closely resembled the 1½-ton Fiat of 1912. With the exception of the magneto, tires, headlamps and a few trimmings, the whole job was built from the ground up, under tremendous handicaps. For example, the forge shop was equipped with two or three old-fashioned open side steam jobbing hammers; fenders were hammered out of the sheet by hand and finished off at the corners with an oxy-acetylene torch. However, the plant as a whole was rather well organized as to layout and incidental equipment, in the terms of 200 units per month.

This plant was the product of an enthusiasm for the motor car and American manufacturing practice. Started originally during the war, the machine equipment which was ordered from the United States was lost in the shuffle during the revolution and finally gathered up from various points along the Trans-Siberian railway, and the plant began its struggle

*"Tractor Is King in Soviet Russia," by Walter L. Carver, *Automotive Industries*, March 5, page 375.

Soviet Vehicle Plans



Posters ask for the cooperation of foreign workers

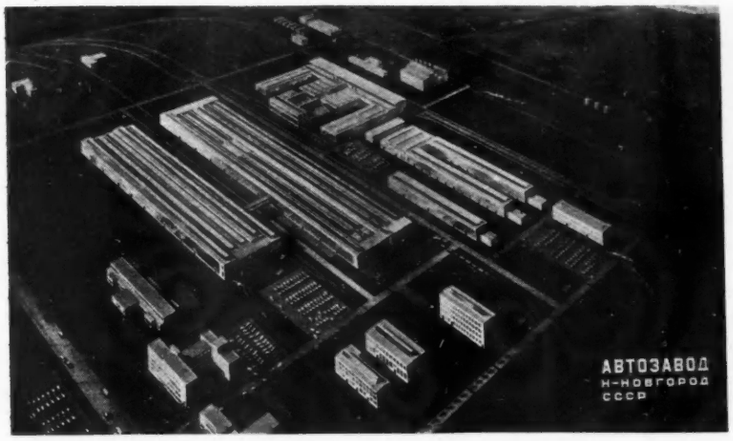
for existence. As the result of this effort which started in the early days of the reconstruction period and the infusion of a number of repatriated Russians who had worked in automobile plants in this country, this plant has an appreciable percentage of skilled and experienced help. This unusual characteristic is particularly evident in the tool room. That this is a pronounced asset can only be realized when it is recognized that the average Russian plant of today must be self-supporting to the last degree. The purchasing agent cannot grab a phone and have a jobber's truck around at the receiving room within a few hours. Without going into details, the present plant, which is producing a 2½-ton truck modeled after the Autocar, is by far the largest and best equipped plant in the world devoted solely to the manufacture of trucks and buses. Basically, the equipment is the last word in American practice. From the forge shop, which is equipped with batteries of steam and board drop hammers, forging machines and furnace equipment, and the foundry with its bull ring, continuous pouring floor, sand conditioners, etc., through to the final assembly and finishing department, no detail has been missed. The press room is a dead ringer for some of ours. With improving managerial technique and adequate contributory support, there is almost no limit to the potential capacity of this plant.

Amo's companion heavy truck plant at Yaroslavl, about 150 miles north of Moscow, utilizes the same basic design at present. Engines are bored somewhat larger, the frames are reinforced and special heavy axles are fitted. For the time being this plant will fill the gap in the heavy truck field.

The new Ford plant outside Nizhni-Novgorod has been the subject of so much publicity that comparatively little can be added in this direction. I visited the site for the first time in December, 1929, and it was cold. The only identifying feature was the enthusiastic statement of my guide that this was the site of the new automobile plant. Upon my return nine months later, hordes of people were at work, most of the foundations were in and some of the walls were part way up, but the possibility of inaugurating production within two years seemed as remote as Mars. This last fall many of the buildings were roofed over and greater hordes of people were at work, but the possibility of plant operation within a year still looked remote. Nevertheless, the buildings were completed on Nov. 1 of this year. By spring the beginnings of a production program will be well under way. This plant is another which is a matter of national pride. In fact each of the new industrial projects can be classed in this category. Plans may be modified somewhat, but failure is not brooked.

The program of this plant for the current year is 70,000 cars, the major portion of which will be trucks. Since the Soviet contract with Ford runs until May, 1933, the gaps and shortcomings of the new production program will be rather adequately reinforced. Meanwhile several hundred Russian students have been trained at Dearborn, and many of them have been at work at the assembly plants which have been running in Russia.

A small temporary assembly plant modeled along Ford lines was opened in



Autostroy at Nizhni-Novgorod has an initial capacity of 140,000 Ford type cars annually

Nizhni-Novgorod in January, 1930, and has been turning out 20-25 cars per day rather consistently since that time. A model assembly plant was opened in Moscow in November, 1930, with 80-100 cars per day capacity. This plant might be used as the prototype for export assembly plants in any country as regards equipment and arrangement. However, a return visit there this last fall indicated that its management was not fully conscious of its job. The value of its excellent facilities was being discounted badly by lack of attention to details, particularly in the handling of materials and the disposal of incoming crates and boxes. Small parts storage had departed seriously from a closely planned routine, and some of the mechanical operations indicated a greater regard for numbers than for quality. This assembly plant with one in Kharkov constitute the nucleus of a number of such plants which will be located in the various trade and industrial centers of the country.

This program as developed up to date provides for truck requirement over a broad range, the Ford type light delivery and 1½-ton, Amo 2½-ton and its Yaroslavl subsidiary in the heavy field. Also the small passenger car field is reached by the Ford development.

Soviet planning engineers already are discussing the so-called baby-car prospects. One possibility already has been discussed in the Russian papers, a four-cylinder, air-cooled engine of 1.1 liter displacement, individually sprung wheels are some of its characteristics. To the foreign engineer it seems that the selection of this novel type rather than some more conventional, tried practice constitutes the hard road to early development.

The obvious gap in this program, particularly from the Russian point of view, is the absence of a passenger car in what would be our upper middle price class bracket. In view of the demand for cars of this type by the army, government and commercial agencies, something remains to be done in this area, and provisions probably will be made for this purpose in the next Five Year Plan. There has been some talk of a combine with headquarters in Cheliabinsk for the production of this type of car with some others which would fill in the gaps in detail in both the passenger car and truck fields.

It is a matter of purely personal opinion that the policy of building integrated plants, particularly in the motor car industry, is on the wane. Heretofore the problems of production in Russia have been so acute

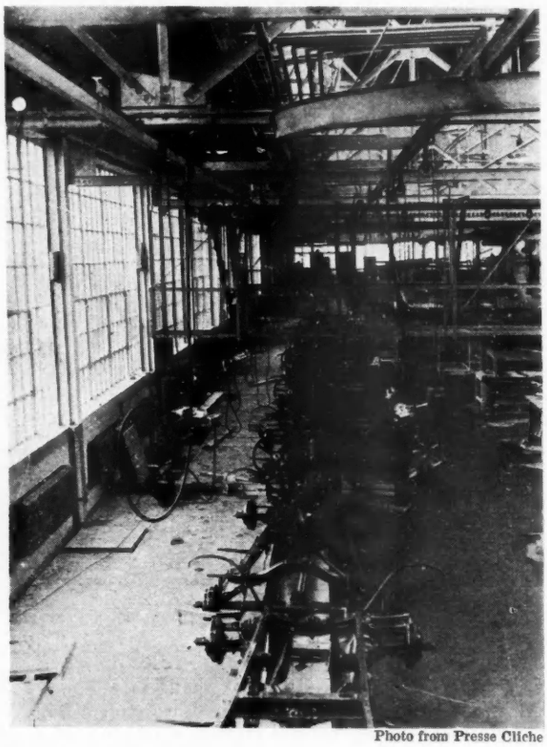
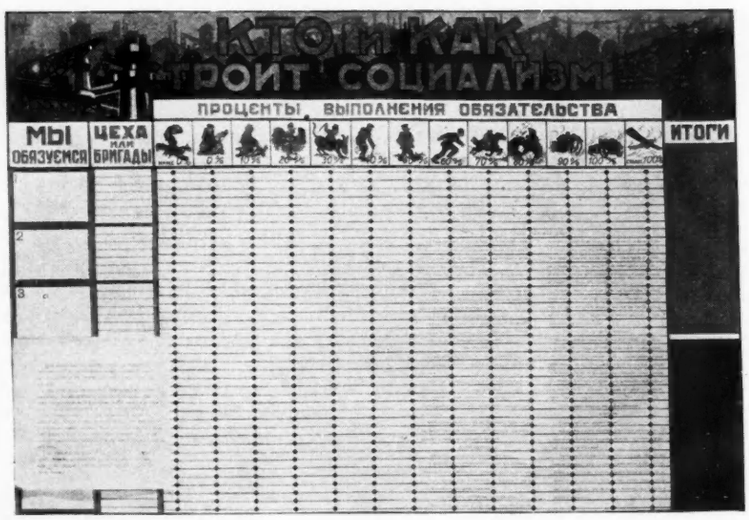


Photo from Presse Cliche

Main conveyor in the plant at Moscow



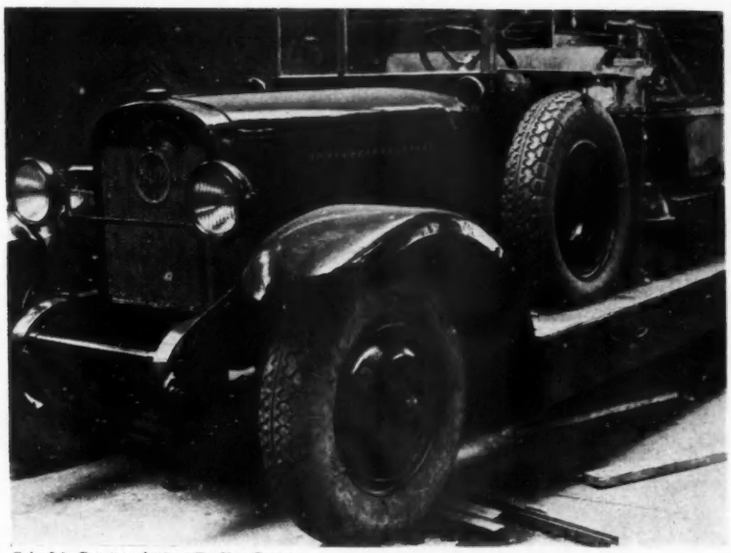
This type of chart is used for the purpose of indicating the standing of various contending parties in a race of socialistic competition.
The first column consists of 6 sections and contains a description of the obligation undertaken by the shop or by one of the labor brigades.
The next column should contain the name of shop, brigade or brigades participating. The dotted field in the center shows the standing. Small pins with varicolored flags are inserted in a dot on the proper vertical percentage line and such horizontal lines as correspond to the name of the participating contender
The original poster was in color.

that it was necessary to center all phases of production activity at each chosen point. The new Ford plant represents the first departure from this program. I believe that further development will follow the line of more highly functionalized plants such as casting centers, forging centers, gear plants, and motor, transmission and axle plants. With the experience already acquired and a clearer knowledge of industrial values, such functional centralization should work toward more rapid technical development, greater flexibility and lower costs.

In this resume of automotive activity, nothing has been said about motorcycle or aviation development. A motorcycle plant already is in the early stages of a production program. Since the aviation program departs from the area of purely industrial interest, I know very little

about it and in this respect am in much the same boat as other foreigners. However, there is reason to believe that its development is just as active as that of the tractor and motor car fields, which have been highspotted here.

A word about the highway situation. The streets in the larger cities are being resurfaced at a rapid rate, but the intercity or cross-country highways still are in rather deplorable condition. Distances are so great that a comprehensive hard highway program presents real difficulties. However, increasing attention is being devoted to ditching and crowning earth highways, and the theory is that the increase of the number of available motor vehicles will dramatize and bring home the importance of good roads to each community and thus win a greater degree of local support. Also that improved roads will attract more motor vehicles and thus stimulate still further highway development.



Sojuzfoto Courtesy Amtorg Trading Corp.

This fire apparatus was built in the No. 6 Vato factory and is equipped with a centrifugal hydrant

Since this is a story of progress, it does not seem necessary to dilate on the difficulties which are encountered. There are plenty of them: Floating labor, with more than a trace of nomadic instinct, lack of experienced supervisory and technical personnel, shortage of material, inadequate transportation, muddleheaded thinking and conduct on the part of some of the superenthusiastic subordinates; these are just some of the difficulties which have impeded progress from an absolute standing start in a country which was riddled by a decade of war, revolution and civil war. The saving grace of the whole situation seems to be that the government is on the *qui vive*, takes its full burden of responsibility, and does something to meet each problem while it still is a problem instead of history.

All of the plants discussed here have been equipped almost entirely from American sources, but it can be said that until world political and economic affairs pass out of their present phase, no appreciable volume of new equipment business can be expected from this source. There is a distinct admiration and appreciation of American production methods, since they are alone of the same scope that is the goal of Russia. But with conditions as they are, the Russians are learning how to adapt equipment from western Europe to our scheme of production. Meanwhile they are pushing development in their own machine tool and factory equipment industries and already tools of Russian manufacture are appearing in production lines.

A similar thought applies to the purchase of cars and trucks, although there is added in this respect the Russian policy against entering into purely sales agreements for commodities which they feel should be produced in Russia. Automotive vehicles are in this class. True, Russia places casual orders for relatively small lots of cars, trucks, etc., outside from time to time, but this action is regarded as being of purely temporary, emergency nature. In such procedure, credit terms play an important part, and the business is placed in the western European countries which have government credit guaranty facilities. Italy has received the major share of import business during the past year or more, chiefly trucks for use in the south and on state and collective farms. Germany and England have participated to a much smaller degree. There is no reasonable expectation for sales of any great magnitude over an appreciable time period unless the manufacturer makes some definite commitment which looks toward cooperation in production development in Russia.

The market there is far in advance of the ability to produce and, it is presumed, will continue to grow in advance of production ability for many years to come. But with each added month of experience and development, responsible officials are more convinced of Russia's ability to stand on her own feet, particularly when a decision concerning heavy sales commitments outside is balanced against the objective of production development inside of the country.

This article takes no cognizance of differences in political opinion or the type of backstairs gossip which can be related of any country. Industrially, Russia, as typified by her automotive industry, is definitely on the road to progress. The people have learned their lesson in construction work and seem to be well on the way to similar education in production work, although this is a more difficult road. I have yet to see a starving Russian, and despite the fact that this government has chased them down from the shelf over the kitchen stove and put them to work, most of the people seem to be getting a satisfying kick out of their jobs.

For the past two years AUTOMOTIVE INDUSTRIES has had pleasure in offering its readers a concise, authoritative annual review of world rubber markets by Harry Symington of the internationally known firm of rubber factors, Symington & Wilson, London. Mr. Symington's review of 1931, with his predictions for 1932, will appear in our next issue, March 19.

Machine Tool Makers Can Jump In As Consultants To the Industry

The machine-tool manufacturer has the unique opportunity to be, by invitation, consultant to the world's largest manufacturing industry, which means the world's richest industrial market. Being a consultant under these conditions means knowing the engineers and executives in the automotive industry who are in a position to do the inviting.

This does not involve simply the "recapture" of business which belonged to the machine-tool builder in the first place, as where a tool representative went into the plant of a carburetor manufacturer who was milling flanges on one die casting. The machine-tool manufacturer developed a set of broaches, which increased the productive capacity per dollar 100-150 per cent. That is a case of normal initiative among the more progressive manufacturers.

(Continued from page 413)

stances will permit. Naturally there is a confidential relation in such a discussion which must be respected by the tool salesmen, and it is up to him to prove that he is worthy of the trust, and that his company is capable of being of service. The best way he can prove it is to produce, or get from his own organization, enough new ideas of value to the vehicle engineer to make it worth while for the engineer to conclude that he has not been listening to "just another sales talk."

We were discussing recently with the vice-president of one of the more progressive tool manufacturers his contact problems in the automotive industry. He made the statement that his company had been unable, through its local representative in Detroit, to make the proper contacts with one of the largest automobile manufacturers. We seized the opportunity to ram home one of the points we have been trying to make in this article, and arranged a session between the vice-president and some of the engineers of the car manufacturer in question; on the basis that the session would not be used directly as an attempt to influence the engineers in favor of the purchase of the vice-president's own brand of machine tools.

The engineers opened up like morning glories. File-doors banged open and out came blueprints. Here was a design problem for which a solution would be required within six months. Looked like a headache unless they got outside help. Here was another production problem that had given two assistant engineers gray hair. Could the tool maker's engineers have a look at the blues? They certainly could and there would be a big prize to the smart boy who figured out the answers.

The prize in one of these cases represented a crack at a tooling order approximating $100,000. One contact got the chance. And assuming that the tool engineers are competent to solve the problem, the right contact represented 90 per cent of the effort involved.

Every new component that goes into a car should be watched by the tool builder even more closely than it will be by the parts manufacturer and the competing car makers. The success of the component as a sales feature on the first car to use it means potential tool business, and the tool maker must be in a position to supply the necessary tools to make the component when the demand develops. Valentines are sold in February, but they are manufactured during the previous March, and the ideas which go into their make-up are developed *eighteen months* before the public spends money for them.

One more example. Transmissions involving the use of cone clutches or "brakes" for the synchronizing of gear speeds before engagement were introduced several years ago by the Cadillac Motor Car Co. One or two other car manufacturers followed within a period of six months or a year with similar designs. These were successful in proportion to whether the production rate was small enough to permit the economical maintenance of sufficient inspection and supervisory control—because the cone clutches had to be produced to tolerances measured in 0.0001's in. for out-of-round and concentricity. A beautiful bottle-neck for a big production plant! Only after a development period during which machine tool makers turned out equipment capable of producing cones of the necessary accuracy on a high-production basis did the synchronizing-gear transmissions make the headway necessary to meet the demand for them in low-priced cars. The fact that one of the largest automobile manufacturers is enabled to include this type of transmission in his latest model is due to calling in a machine tool builder who developed an entirely new finishing process and machine tools for carrying it out. These tools will naturally find a ready market in the plants of other transmission producers.

Taking a broad look at the automotive industry, the production of any new motor vehicle represents a definite cycle of events, in which the tool maker plays a vital, but insufficiently-recognized part. Without the tool builder the knowledge of the vehicle engineer is limited to production processes and the tools available (catalog stuff!). Without the knowledge of what's coming in the way of new automotive developments, the machine tool maker cannot do much to produce new tools to put these new developments quickly into production.

Who gives the biggest compound curse when production of a new car, or a new component is held up? Not the engineers, though they take it on the chin as a result. Not the production men. It's the sales executives and the policy makers. The men closer to distribution, whose white hairs are gathered from screaming for quick deliveries on the new model. If you've got something good, Mr. Toolmaker, these are the men who will be interested in knowing how tools sell cars, when the tools make something which can be advertised as a sales feature.

JUST AMONG OURSELVES

Demand for Red Ink Lags

BELIEVE it or not, we heard a couple of pretty important business men talking optimistically the other evening—and not for publication. One of them, a prominent corporation lawyer, even went so far as to express the belief that the back of the depression definitely had been broken.

If this thing keeps on, we'll begin to write about business conditions again ourselves before you know it. Of course, one of the automobile distributors who sat in on this same conversation did add: "Well, if the depression is passed, we must still be struggling in its wash." But even he grudgingly admitted that his sales had been slightly better during the last week or so.

Probably it's too soon to uncross our fingers, even though they are stiff from remaining in that uncomfortable position for so long. Nevertheless, some of the chill seems to be going off the economic weather even though the sun hasn't begun to break through the gray skies.

Better Than It Looks

IT is easy to get the jitters by sitting around looking at the motor vehicle sales and production figures for the first quarter of 1932. In fact, we know of no less inspiring occupation at the moment.

But it's well to remember how big a factor is Ford in making high output totals. Everybody knows that, of course, but it is surprising how many seem to forget it when wailing loudly about first quarter production being off nearly 30 per cent from last year—as it will be, although 40 per cent may turn out to be a closer guess.

In the first quarter of 1931, there were built in the United States and Canada 572,544 passenger cars. In the first quarter of 1932, the total in all probability will be about 350,000. That's a difference of 222,000. It's a big difference to be sure, but the state of the industry isn't so bad as one might think when we realize that Ford built about 160,000 passenger cars in the first three months of last year.

Decline in production among N.A.C.C. members for the first quarter, in other words, probably will turn out to be little more than 10 per cent under last year, despite the unquestioned delay in buying caused by Ford's failure to announce.

Business isn't good. But it isn't nearly as bad as it might look while reading total figures.

Smaller Hazard With Rear Engines

"WHAT would happen to the passengers in a rear-engined car in case of a head-on collision?"

This is one of the questions most widely asked by engineers and laymen when discussing this type of design. We had a chance to query Sir Dennistoun Burney the other day and his answer was: "Not as much harm and probably less than in a car with the engine in the front."

Sir Dennistoun has a specific technical reason for making such an answer, but he has also what is even more impressive, personal experience. He was being driven by his chauffeur one night in his rear-engined car when, due to an unforeseen road condition, the car had to take a bank at 40 m.p.h. and struck a telephone post end on, at considerable speed. Lady Burney, who was in the back seat, was thrown violently forward but was not seriously injured, neither was Sir Dennistoun nor his chauffeur, although the latter suffered minor bruises. The frame of the car was bent and the front crumpled up, but the car was driven back to London under its own power.

"The crumpling of the front portion of the car," Sir Dennistoun says, "acted as a recoil cylinder and thus minimized the intensity of the shock. If the engine had been in the front, the rigidity of construction of the engine would have checked this crumpling and thus intensified the shock."

5000 Man-Hours Produced a Desk

OUT in Kenosha the other day we saw over in the corner of Charles W. Nash's plainly furnished office a most marvelous desk of wood inlay. Inquiry developed the fact that there were 33,800 of the multicolored pieces of wood used in making this unusual piece of furniture and that 30 men had worked on it six full months.

The desk, which bears the Nash emblem in the center of its top, was the gift of the Nash Syrian distributor to Mr. Nash.

Guesswork— Minus Guess

R. W. BROWN, in charge of Firestone's engineering laboratories, gave a definition of "research" the other day which we think well worth passing on. "Research," he said, "is what's left after you take the guess out of guesswork."—N.G.S.

Manufacturing Control and Service

by Joseph Geschelin

Fig. 1 — As the axle comes off the chassis assembly line on to a checking fixture, and held in place by an air-operated clamp. One knuckle is set in the fixed block at the left, at the correct angle. The other knuckle drops into the adjustable block at the right

LIKE a hardy perennial, front wheel alignment discussion blooms afresh each year — despite the fact that we have always had a steering gear of some kind, and sound engineering principles have been pretty well established. True, balloon tires complicated the situation at first. But the tire people pitched in and helped clarify the new problems. In fact, the work of Hale (1), Stewart, Lemon and others, almost four years ago, is still the criterion today.

Is there a way out of this maze? We suspect there is—and propose to show several missing links we uncovered recently. Not exactly missing links, but important things that have been brushed aside in the rush.

Front wheel alignment is no simple design problem. The Ackerman principle has been known from time immemorial, and modifications have been made to improve it. Gyroscopic forces—their direction and intensity—have been thoroughly analyzed by competent engineers. Yet front wheel alignment at the best is a compromise based on more or less empirical knowledge.

Among other things, the steering linage is a complex kinetic chain with flexible elements which defy exact analysis. Then there are the variations in manufacturing limits, balance, tire inflation, and the added difficulty of estimating actual operating conditions and allowing for them in the initial design.

But to cap the climax, whenever a roomful of engineers concentrates on these problems there is a distressing lack of unanimity on many basic elements. And when you add the voices of the practical men who are doing things in the field, there is indescribable confusion. Which is precisely what happened at the front wheel alignment session at the S.A.E. annual meeting. Isn't this simply an inevitable result of human nature? Many men are working on perhaps the same problems, but they look at them in different ways and sometimes do not speak the same language.

Suppose we resolve our problem into the following elements:

1. Steering geometry and steering performance.
2. Tire wear.
3. Abnormal effects such as shimmy, etc.
4. Manufacturing problems.
5. Service problems.

Now, elements 1 and 2 concern the engineer a lot because they control car performance. No. 3 is of greatest concern only to the car owner and the tire maker. Element 4 is the *first* missing link. No. 5 just worries the car owner, the service man, and the equipment maker; this is the *second* missing link.

If we recognize the unmistakable gaps in the picture and bridge them over; if we take steps to control some of the uncontrolled things, we shall be very close to a positive solution. First of all, it seems self-evident that items 1, 2 and 3 are concurrent and are intimately related to a general treatment of item 1 by the engineer.

(1) "Relation of Wheel Alignment to Tire Wear," by J. E. Hale and C. R. Stewart, paper read at a meeting of the Automotive Service Assn., N. Y., May 10, 1928.

Experience Hold Key to Wheel Alignment

Caster, camber and toe-in must be reduced to the smallest practicable values before better results can be expected

The next thing is the manufacturing problem. When the engineer takes a lot of pains to correct design, particularly if the elements are so critical, surely something should be done to assure the exact maintenance of dimensions as the car comes off the assembly line. Some evidence that this is at present uncontrolled may be found in the report by J. M. Nickelsen (2) at the annual meeting. Of the 71 cars tested at the G.M. proving grounds, less than half met the manufacturer's specifications of toe-in, camber, caster and steering-knuckle pivot inclination.

Isn't it likely that the answer lies in the variables involved? If the answer is yes, it demands the establishment of definite manufacturing tolerances and adequate testing equipment. Consider just a few of the variables:

1. Steering arms—length and angularity.
2. Front spring—camber, center-to-center of eyes and location of center bolt.
3. Axle center—dimensions, deflection, twist.
4. Tie-rod length.
5. Drag - link dimensions.
6. Location of spring brackets on the frame.

A good method of control is the one shown in Fig. 1, which assures correct positioning of steering arms and proper tie-rod length. But in addition there should be a good final inspection device at the end of the assembly line to assure correct alignment of the entire front end. If it does not check within specified limits, the alignment should certainly be readjusted.

One large car manufacturer has established a set-up of this nature. It consists of a separate front-end department with ample facilities for carrying on the work. Production cars go through this department, and front alignment is carefully checked on standardized equipment. Variations from standard are closely watched, experimental work is carried on to establish the best conditions, and finally a recommended change-in-practice is submitted to the engineering division. Improvement in performance, increased tire life, etc., resulting from this have been remarkable, to say the least.

Here is the second missing link just waiting to be picked up. It lies with a group of men who have spent years in building wheel-aligning equipment and studying tire wear and its related problems. These men have a wonderful fund of information, and a good deal of it could be put to immediate and practical use by the engineer. Nor are these men so far apart in their recommendations as one might think. In the final analysis they are all working for the same objectives except that their method of approach varies with the character of the service they are selling.

What is needed right now is some definite standardization of dimensions and inspection methods. It is claimed by a few well-informed people that some of the aligning equipment now on the market is not sufficiently accurate, and that the error in the instru-

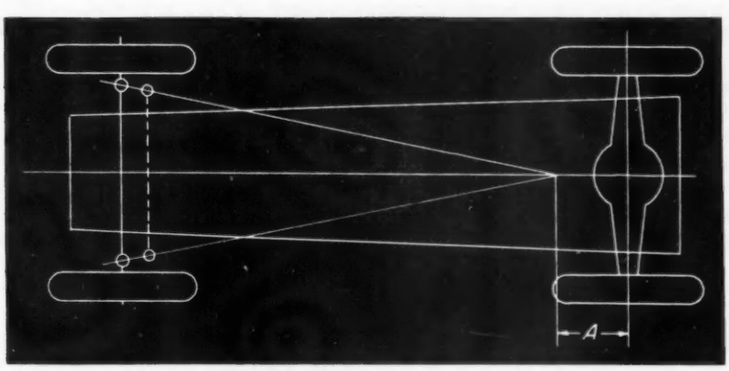


Fig. 2—Location of A, intersection of steering arm prolongation on axis of chassis, has important bearing on tire life

(2) "Analysis of Work and Conclusions of the Front-Wheel-Alignment Subcommittee," by J. M. Nickelsen. 1932 annual meeting paper, S.A.E.

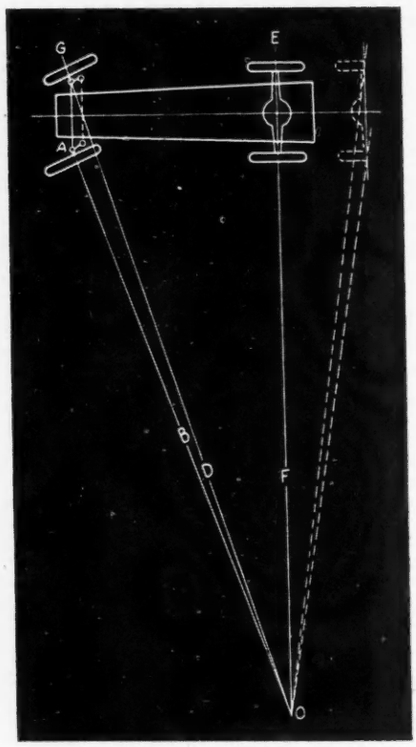


Fig. 3—Diagram showing instantaneous center of rotation at O. The entire chassis is assumed to turn about the line OFE, while each front wheel assumes a position normal to the radius from O. Dotted lines show the result of using the same axle with changes in wheelbase. In this case, point O is constant thus forcing the rear wheels into oblique positions which they can not follow. Tire wear results

ment may exceed the dimensions being checked. In general, there is a definite need for simple, accurate instruments in the manufacturing plant as well as in the service station.

And finally, when an acceptable instrument is adopted, the same make and type should be installed in the factory-approved service stations. Thus you will be sure that you are checking the same things in the same fashion.

Throughout the following no attempt is made to go into a mathematical treatment of the various elements because this would involve considerable duplication of effort. Moreover, such material is already available in contemporary literature. We also hasten to point out that what is said here applies chiefly to passenger car practice and applies only in principle to truck design. As a matter of fact, the values of camber, caster and toe-in for truck work are considerably different.

Leaving this retrospect for the moment, let us examine current opinion concerning the fundamentals involved in front wheel alignment. Consider first the general aspects of steering geometry. The consensus is that the values of camber, caster and toe-in must be held to a minimum. Steering arm length and angularity are elementary considerations, yet there is a lack of unanimity concerning the best relations. For instance, Fig. 2 shows the usual layout with the prolongation of the arms intersecting on the longitudinal axis of the chassis somewhat ahead of the rear axle. But how far ahead?

According to reports from the field, this distance, A, varies from 24 to 48 in. Is this permissible? The car maker mentioned earlier is working on the basis that A = ⅛ of the wheelbase approx. This would set A at about 15 in. for a wheelbase of 120 in. There seems to be sufficient reason for making A, a minimum if good steering and tire life are considered. For this reason it is urged that the steering arms be changed when the same front axle is used on a line of models with different wheelbases.

Another elementary condition is that shown in Fig. 3 demonstrating that on a wide turn the inside wheel turns through a larger angle than the outer because of the difference in turning radius. It also shows the relative amount of toe-out on turns and the change in wheelbase—greater on the outside and less on the inside. This is given simply to illustrate the uncontrollable errors under operating conditions. Fortunately it is possible to keep these at a minimum and thus increase tire life and it is suggested that the answer lies in the proper adjustment of steering-arm length and angularity.

When we get down to cases, the first troublesome factor is *camber*. Without going into its origin and history, it is possible to cite a number of good reasons why camber is with us. Here is a brief list:

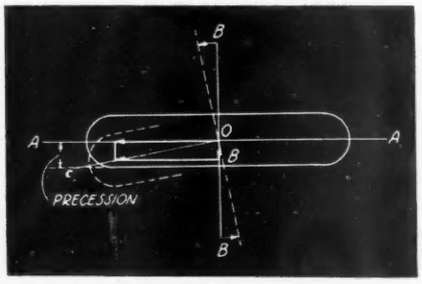


Fig. 4—Simple explanation of precession due to exciting forces on a gyroscopic body. Assume a wheel rotating anticlockwise as represented by the force vector OA. Now suppose that the axis (spindle) is tilted by a force tending to move point O out of the plane of the paper, i.e., into the vertical plane. This will produce a force represented by OB in the horizontal plane and the wheel will be forced to move in the direction of the resultant OC

1. To compensate for variations in the flexible kinematic chain and thus avoid negative camber.
2. Some compensation for crowned roads, permitting normal contact to some degree between the tire and road.
3. To reduce side thrust on the king pins and take up end play by forcing the assembly against the thrust collars.

The amount of camber depends upon axle construction to a large degree. Thus, although opinions concerning center-point steering vary, it is agreed at least that the extension of the king pin center should intersect the ground line inside the tire line if not within the area of contact with the road. Therefore, with inclined king pins, the camber may be an absolute minimum while with straight king pins it must be somewhat greater.

With center-point steering and inclined king pins, camber is not a factor in steering performance so long as it does not exceed 2 deg. each side. But recent tests prove that camber affects tire life profoundly. Current opinion is that under actual operating conditions, camber should be from 0 to ¾ deg. each side; it will be greater, of course, when the vehicle is unloaded. Desirable production limits are ½ to 2 deg., with 1¼ deg. preferred in selective adjustment.

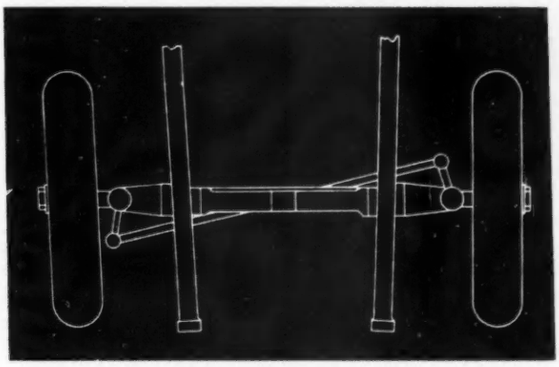


Fig. 5—Cross tie-rod construction used by German experimenters to demonstrate the possibility of cancelling gyroscopic forces. This tie-rod is rigid and is forced to move through a bearing under the axle center

The next factor is *caster* and it's with us because it:

1. Affects steering performance chiefly.
2. Assists wheels to straighten up after a turn.
3. Prevents negative caster.
4. Aids in running in a straight line.

When vertical king pins are used, caster is quite large but with the inclined pins it can be very small due to the lifting or caster effect of this construction. Insufficient caster results in wandering and difficulty in straightening up after turns. Too much caster will make it difficult to turn the wheels right or left and causes them to straighten up violently, and may induce shimmy.

Although caster is important in steering it is about negligible so far as tire wear is concerned. According to Barnes ([3]), caster is very sensitive to operating conditions and under certain extreme conditions such as braking and striking obstructions will vary as much as 5 deg. negative. Herrman ([4]) found that caster should be between 1 and 2 deg. and should not exceed 2 deg.

Recommended current practice is 0 to 1 deg. under driving conditions; the setting at the factory should be correspondingly higher. Another important consideration is that of wheelbase and loading due to seven-passenger models. Unless correspondingly heavier rear springs are fitted, the caster angle will be increased beyond safe limits under driving conditions.

Next we come to *toe-in.* This is one of the most critical elements of this critical problem. Its main function is to compensate for whatever camber is present. Briefly, the mechanics of it is that camber introduces a tendency for the wheel to roll outwardly and accordingly sufficient gather is put in to balance the tendency, eliminate slippage and achieve true rolling contact at the ground. If the nice balance is absent or is disturbed, either at the assembly line or in service, abnormal tire wear takes place.

Another function of toe-in is to take care of the manufacturing variations which might tend to create a negative effect, *i. e.*, toe-out. It is affected by the angularity and length of steering arms and consequently depends upon the length of the tie rod. Variations at these points may cause a serious toe-out in making turns.

With the present tendency toward a decrease in the value of camber and caster, toe-in should be held to an absolute minimum; suggested practice is 1/16 to ¼ in. overall, *i. e.*, including both wheels, with ⅛ in. preferred.

No doubt it is unnecessary to dwell much on the geometry of the draglink. It is accepted that the linkage should be so disposed that the ball ends of the drag-link and the center of the forward, front spring eye are in a straight line. This is the position of minimum disturbance of the linkage under spring deflection. Where the spring is shackled at the front, the layout is not so simple but many feel that the prolongation of the line through the ball ends should intersect at a point about midway between the centers of the front shackle.

While *shimmy* and other related abnormalities require careful handling, it is said that they are practically unknown on present cars. But shimmy does develop in service and the experience in this field may be of help to the engineer. The chief factors concerned in these phenomena are briefly:

1. Errors in steering geometry (contributing exciting forces).
2. Sensitivity to tire inflation pressures.
3. Good wheel-and-tire balance.
4. Reaction of gyroscopic forces to exciting forces, see Fig. 4.

Since wheel balance is controllable it should be scrupulously watched because at high speeds the effect of minute variations becomes serious. Here is an example of the corrective effect applying a weight of

([3]) "Front Axle Movements," by W. B. Barnes. S.A.E. Transactions, Vol. 24, 1929.
([4]) "Tires as a Cause of Shimmy," by K. L. Herrman, Part 1, Vol. 22, S.A.E. Transactions, 1927.

only ¼ lb. at 12 in. radius on one spoke. If F is the centrifugal force in lb., then its value as given by the familiar relation, $\frac{wv^2}{gr}$ can be simplified to the form, $F = 1.226\ w\ n^2r$, where w is the weight in lb., n is the number of revolutions per second of the wheel, and r is the radius in ft. at which the weight is applied. On this basis, the correction of ¼ lb. has balanced a centrifugal force of about 37 lb. acting at a lever arm of one ft., assuming a 30 in. tire at 60 m.p.h.

Natural *gyroscopic* forces are always present and ready to respond to exciting forces. The usual treatment is to damp the action or shift its effect beyond the operating range or to do both. The Germans have gone one step further in speculating on the possibility of actually neutralizing gyroscopic effect. At the last S.A.E. annual meeting, Dr. H. C. Dickinson showed a film taken during the course of recent research work in Germany. As a laboratory experiment, Becker and his associates (5) rigged up a rigid diagonal tie-rod connecting the left steering knuckle pointing rearward with the right pointing forward as in Fig. 5. This neutralized the gyroscopic forces of the balanced wheels and stopped the shimmy as if by magic. Perhaps something practical can be developed from this laboratory demonstration of value to the industry.

Based upon conversations with a group of engineers and well-known figures in the service field, the writer makes the following recommendations:

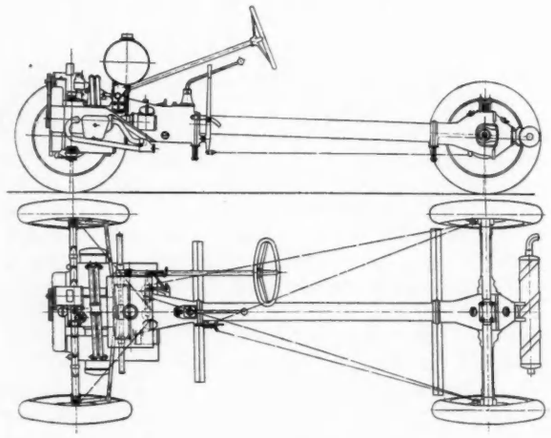
1. Establish the smallest practicable values for caster, camber and toe-in. The following are suggested subject to special conditions. (These are desirable limits for operating conditions and are not the values used in production. Necessarily, the production values will be adjusted in a suitable manner.)
   a. Caster—0 to 1 deg.
   b. Camber—0 to ¾ deg.
   c. Toe-in—0 to ⅛ in.
2. Develop manufacturing limits which will assure the values recommended for running conditions.
3. Adopt a suitable commercial checking device for the final assembly line.
4. Recommend the same equipment for branches and service stations.
5. Make service instructions concrete, giving the limiting values and the conditions under which they are to be checked.

(5) "Schwingungen in Automobil-lenkungen (shimmy)," by Becker, Fromm and Maruhn.

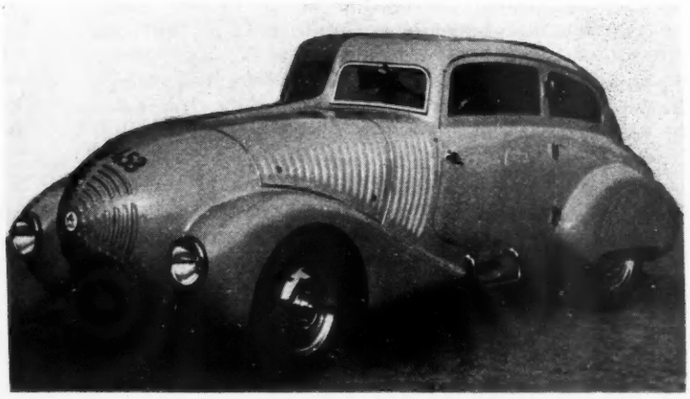
Streamlined Wikov at Prague Show

A CAR of very pronounced streamline form, with a superstructure reminiscent of the body types developed by Jarray in the Zeppelin wind tunnel, was exhibited at the recent Prague automobile show by Wikov. It consists of the Wikov firm's standard Model 35 chassis with four-cylinder, four-stroke engine of 112 cu. in. displacement, with a special streamlined body. As may be seen from the photograph reproduced herewith, the front end treatment of the body is decidely original. Headlamps are set into the front of the front-wheel fenders, which latter are of streamline form but open on the outside, to permit of the necessary steering motion. The upper parts of the driving wheels are completely inclosed in the rear fenders. From the general form of the car it is obvious that its air resistance must be quite low. On the other hand, the accessibility of the powerplant probably is not all that might be desired.

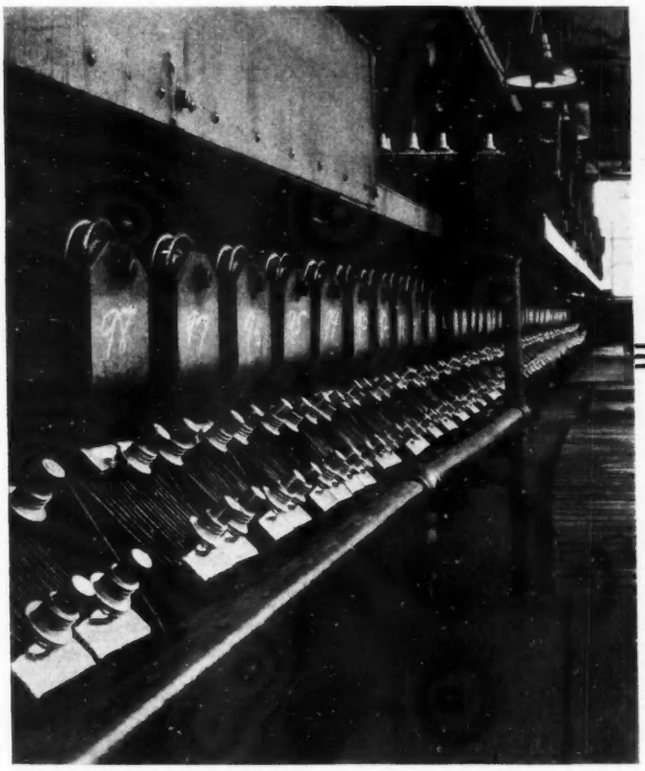
Another interesting model exhibited was a Tatra small car chassis with an engine of one liter (61 cu. in.) displacement. It has a tread of 48 in. and a wheelbase of 103 in., and the chassis weighs only 1100 lb. Details of construction are lacking, but the engine seems to be a double-cylinder opposed type with a supercharger mounted in front and taking the place of the flywheel. As in other Tatra models, a tubular backbone is used instead of the conventional pressed-steel frame. Driving axles are of the oscillating type and all four wheels are independently sprung, by means of half-elliptic cross springs. At the front there are two such half-elliptic cross springs, secured to the top and bottom of the powerplant respectively.



Above — Elevation and plan of Tatra small car with independent springing in front and rear



Right — Wikov streamlined four-cylinder car



PRODUCTION LINES

Production Lines of the Industry No. 10

Assembly tables in the production lines of The Electric Storage Battery Co., Philadelphia. The endless belt under the table carries positive and negative groups nested together. The numbered carriers are of different colors, each color representing a different type of battery. Sometimes four or five types are run on the same assembly line.

The operator stands along the wooden board shown in the right margin of the picture. The groups from knee height are placed on the bench in front of him for assembly into other materials that come from an overhead carrier. A center belt on the table carries off the completed battery.

Comfort vs. Output

Human beings can do four times as much work in a temperature of 100 deg. when the relative humidity is 30 per cent than when it is 100 per cent. And can perform at maximum efficiency only between the temperature limits of 40 deg. and 75 deg. Fahr., according to facts quoted in a report "Air Conditions and the Comfort of Workers" just issued by the Policyholders Service Bureau of the Metropolitan Life Insurance Co. Methods of testing temperature, humidity and air flow are discussed; "the comfort zone" is defined. With management doing more thinking along the lines of improving productivity, it looks like a mighty smart thing to give some thought to the "comfort zone." Particularly when this detail alone may cause a decided rise in productivity.

Art in Industry

Production is being perpetuated for posterity through the efforts of artists who have turned their talents to commercial work. Photography is the finest medium of expression at the moment. And remarkable strides have been made in this field. Right now we have on our desk some photos from France showing the activity in the Citroen factories. Each view is so clear, so well defined, that each pictures tells its story without words. Incidentally, Rittase has done some color work for the N. J. Zinc Co. that's a knockout. His plates show color invading the machine shop.

Consider Zinc

Zinc in many forms is invading automotive design. Perhaps the heaviest tonnage is found in die castings for many new applications such as windshield frames, hardware, radiator ornaments, filler caps, etc. One careful study made recently shows that at least 3 per cent of the weight of a certain popular car (not the cheapest one) is zinc.

Practical Engineering

Wonder how many readers are getting the benefit of T-C Comments, issued as a part of the service of Kearney & Trecker. T-C Comments No. 27 has just come in. Five pages of real meaty stuff on full-back cutters and their applications.

Simple Fastenings

Just a few years ago we saw the birth of a simple method of fastening metal to metal, metal to wood, and metal to other kinds of materials. Today, Parker-Kalon hardened self-tapping screws are in use throughout the metal-working industry. They have eliminated certain tapping operations, simplified assembly and reduced costs. Complete technical design and application details covering the whole gamut of P-K fastenings have been incorporated in a new booklet just off the press. It is a welcome addition to your library.

Centerless Ideas

Some new data sheets came in the other day for the Centerless Data Book. These sheets contain excellent material concerning the work, set-up, production figures, etc. Cincinnati Grinders will be glad to send you a data book if you haven't one.

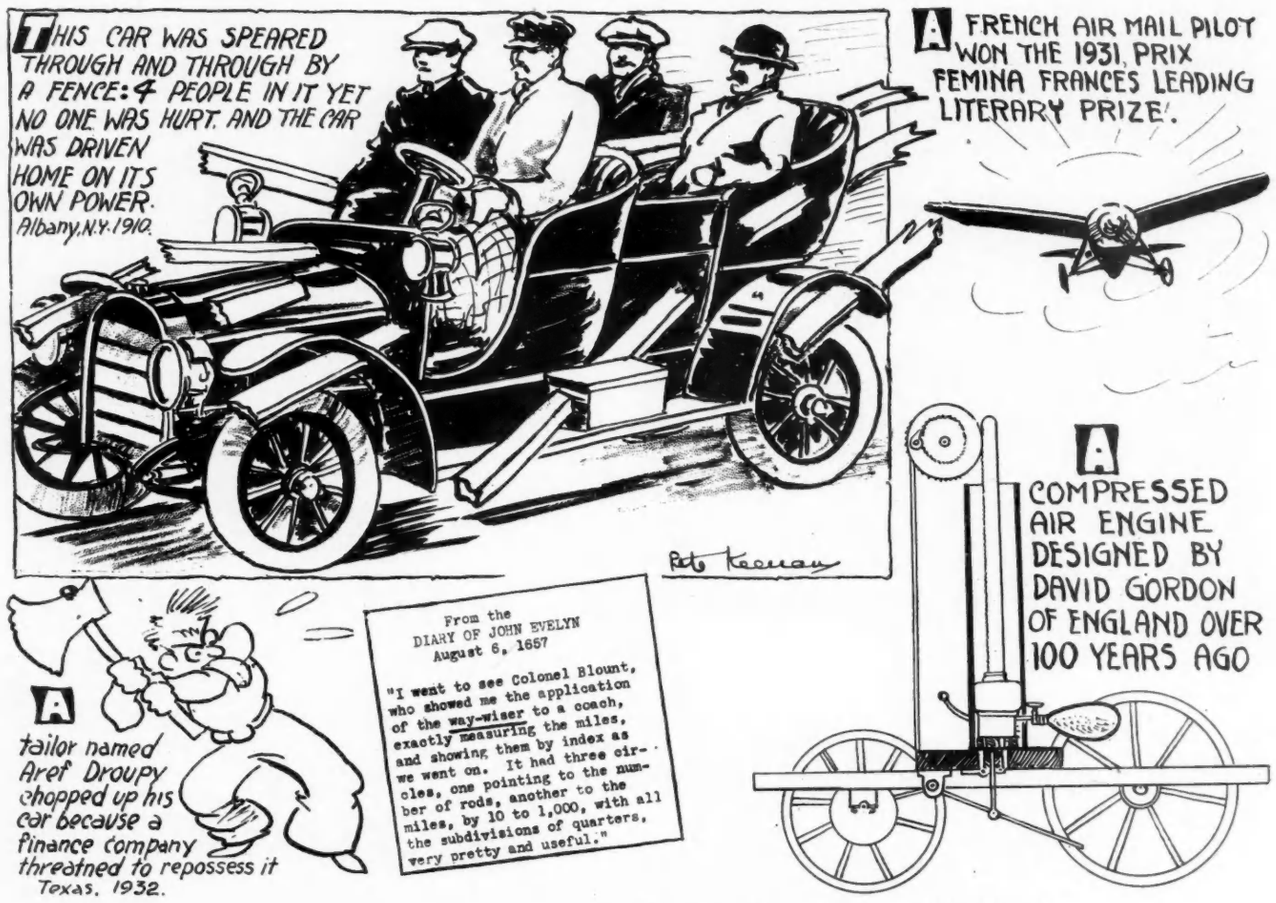
Nickel Comes of Age—

in "The Story of Nickel," which is a booklet built up from articles published in the *Journal of Chemical Education.* Those interested in the historical background for one of the basic materials in the automotive world will enjoy reading this little book—it's free for the asking.

—J.G.

MANUFACTURING MANAGEMENT METALLURGY

Automotive Oddities—By Pete Keenan


THIS CAR WAS SPEARED THROUGH AND THROUGH BY A FENCE: 4 PEOPLE IN IT YET NO ONE WAS HURT. AND THE CAR WAS DRIVEN HOME ON ITS OWN POWER.
Albany, N.Y. 1910.
A FRENCH AIR MAIL PILOT WON THE 1931 PRIX FEMINA FRANCES LEADING LITERARY PRIZE.
A COMPRESSED AIR ENGINE DESIGNED BY DAVID GORDON OF ENGLAND OVER 100 YEARS AGO
A tailor named Aref Droupy chopped up his car because a finance company threatned to repossess it
Texas. 1932.
From the DIARY OF JOHN EVELYN
August 6, 1657
"I went to see Colonel Blount, who showed me the application of the way-wiser to a coach, exactly measuring the miles, and showing them by index as we went on. It had three circles, one pointing to the number of rods, another to the miles, by 10 to 1,000, with all the subdivisions of quarters, very pretty and useful."

Write us if you know an "Oddity"

The News Trailer

"Large tiger wanted.—Engineering firm want to buy a live Bengal tiger. Should be as large and as savage as possible (man-eater preferred); or would hire for a few months; no cruelty." This is the text of an advertisement which appeared in certain newspapers in England the other day and created considerable interest.

The advertiser was G. E. T. Eyston, the well-known British racing motorist, who is head of a firm of London engineers. Mr. Eyston admits his racing and the demand for a man-eating tiger to be not unconnected. In a press interview he stated: "The tiger is wanted for experimental purposes connected with a mechanical device based on a certain theory. At the moment the device cannot be divulged, but if successful it will have valuable results for the motoring world. To test out this theory an alert, powerful animal, which naturally performs certain movements by reason of its muscular development, is required. The proposed experiments will include slow-motion pictures of the tiger performing these movements under varying conditions. We should prefer a Bengal tiger with particularly clear stripes."—R.J.P.

The Philadelphia *Inquirer* has defined gasoline as "a volatile liquid, commonly obtained by distilling petroleum, that is used principally for taxation" . . . for which quip, although we live in Philadelphia, we are indebted to the American Petroleum Institute's newly inaugurated "Gas Tax News."

Los Angeles county, home of eternal sunshine, is a far-seeing section anyway. Its purchase of a Four Wheel Drive snow plow truck recently proved wise in the recent snowstorm. The sale made everybody happy, including the sales promotion department at Clintonville, Wis., for Paramount newsreel showed a scene in which the big F.W.D. was scattering snow all over the climate.

NEWS

February Output Put at 118,559

Figure is Slightly Below January Mark; Ford Lapse Cited

NEW YORK, March 9—American car and truck manufacturers produced 118,559 units in American and Canadian plants during February, according to preliminary estimate prepared by the National Automobile Chamber of Commerce. This compared with 123,075 in January, a decline of 3.7 per cent, and with 229,811 in February of last year, or a drop of 48 per cent.

The fact that Ford was virtually out of production for the past two months is probably responsible to a certain extent for the marked decline in production this year, as compared with last year.

World Trade League Organized

NEW YORK, March 9—The World Trade League of the United States has been organized by individuals interested in our foreign trade, for the purpose of promoting the policy of increasing foreign trade through reciprocal tariff agreements with other countries. This organization will hold a banquet mass meeting at the Hotel Astor Monday, March 21, at 6.30 p. m., at which prominent speakers will discuss the adoption of reciprocal tariff agreements. George F. Bauer is chairman of the executive committee, which includes among others Edgar W. Smith, R. C. Thompson and George E. Quisenberry.

S.A.E. Marine Division Authorized

NEW YORK, March 10—Formation of a marine engineering division by the metropolitan section of the S.A.E. has been authorized by the national council of the society.

G. M. Holders Increase

NEW YORK, March 9—Stockholders of General Motors Corp. have increased so that for the first quarter of 1932 there were 345,194. This compares with 286,378 for the first quarter of 1931, and with 313,117 for the fourth quarter of 1931.

Budd Names Ehle

Edward G. Budd Mfg. Co. has appointed Archibold H. Ehle, formerly vice-president in charge of sales of Baldwin Locomotive Works, as director of sales of its recently organized rail car division. Mr. Ehle was educated at Massachusetts Institute of Technology. He joined the Baldwin company in 1902 and became general sales manager in 1919.

Ford Design Settles Down

Difficulty in Coordinating Equipment Features Slows Progress

DETROIT, March 10—In all probability the end of this week will see the major design features of the new Ford cars settled and production should get under way shortly on a limited scale. Ford's slowness in getting under way has been mainly due to the necessity of ironing out details and the determination of equipment features, the use of which affect other details of car design.

Photographs published this week supposedly of the new Ford bear virtually no resemblance to the new cars which *Automotive Industries* correspondent has seen, but about which no official information may be given.

In all likelihood announcement may be made around the first week in April according to present indications, although this is by no means certain. It would not be surprising to this publication if the new Ford four when introduced would be priced even lower than generally assumed, while the eight, in chassis as well as body, will carry a much greater number of special features than the four.

"Oddities" Contributors

F. L. Titchener, sales manager of the Brewer-Titchener Corp. contributed the reference to John Evelyn's Diary, used this week in "Automotive Oddities" on the preceding page.

Automotive Profits Dropped in 1931

Fourteen manufacturers of automobiles had a consolidated net profit of $99,165,000 in 1931, according to the March issue of the National City Bank's monthly letter. The same companies made a profit of $161,828,000 in 1930, so that the 1931 figure represents a decline of 38.7 per cent in dollar earnings during the year. Net worth of the companies involved declined 2.4 per cent at the end of 1931, the valuation being $1,332,941,000 at the end of 1930, and $1,301,596,000 at the end of 1931. Based on net worth, the 14 companies earned a return of 12.1 per cent in 1930 and 7.6 per cent in 1931.

Manufacturers of parts and accessories did not fare so well. Thirty companies had a consolidated deficit of $1,967,000 in 1931 as compared with a profit of $8,526,000 in 1930, while the net worth of the companies involved declined 713 per cent from $209,507,000 in 1930 to $194,244,000 in 1931.

Rockne Ships 5000th

DETROIT, March 9—The 5000th Rockne 6 was shipped from Detroit plants Tuesday. Production has been rapidly stepped up since Feb. 22, when the "65" went on the line. Production at present is at a rate of approximately 6000 for March. Frank L. Wiethoff, sales manager, states that more than 1100 dealers have been signed, an increase of 100 within the past 14 days.

Peerless Elects Davis

Paul H. Davis was elected a director of Peerless Motor Car Co. at the annual meeting in Cleveland. He succeeds C. E. Sullivan. Other directors were reelected. Stockholders approved the action of the directors in extending the offer by the corporation to buy stock from stockholders at $3.50 a share to March 18 from Feb. 20. The meeting was adjourned until March 21.

Exports, Imports and Reimports of the Automotive Industry For January, 1932—December—January, 1931

	January 1932		December 1931		January 1931	
	Number	Value	Number	Value	Number	Value
Automobiles, parts and accessories	....	$6,764,524	....	$7,924,622	....	$14,531,630
Motor trucks and buses except electric (total)	2,515	1,141,297	3,333	1,534,912	4,642	2,399,315
Under one ton	347	89,591	....	.....	669	224,337
One and up to 1½ tons	1,992	797,111	1,559	676,151	3,290	1,473,954
Over 1½ tons to 2½ tons	113	128,797	148	173,631	531	477,381
Over 2½ tons	47	92,549	86	140,980	103	197,614
PASSENGER CARS						
Passenger cars except electric	4,474	2,427,466	5,753	2,661,221	8,588	5,015,612
Low price range, $850 inclusive	3,877	1,772,204	5,160	2,063,839	6,868	3,056,590
Medium price range over $850 to $1,200	405	385,942	389	369,460	1,025	972,036
$1,200 to $2,000	75	102,144	88	123,758	249	381,435
Over	56	143,667	28	70,926	205	494,329
PARTS, ETC.						
Parts except engines and tires	....	.....	....	.....	....	.....
Automobile unit assemblies	....	1,479,551	....	2,003,112	....	3,935,943
Automobile parts for replacement (n.e.s.)	....	1,394,484	....	1,462,946	....	2,698,391
Automobile accessories	....	164,350	....	153,106	....	304,893
Automobile service appliances (n.e.s.)	....	113, 399	....	155,017	....	245,192
Trailers	12	6,441	12	9,474	38	20,887
Airplanes, seaplanes, and other aircraft	8	116,853	11	41,649	12	202,853
Parts of airplanes, except engines and tires	....	.....	....	95,679	....	205,847
BICYCLES, ETC.						
Bicycles	205	5,106	86	2,280	201	5,364
Motorcycles	208	49,563	109	21,627	328	79,303
Parts and accessories, except tires	....	17,714	....	26,625	....	44,646
INTERNAL COMBUSTION ENGINES Stationary and Portable						
Diesel and Semi-Diesel	4	37,303	10	41,409	33	20,700
Other stationary and portable	....	.....	....	.....	....	.....
Not over 10 hp.	303	22,132	407	28,558	858	64,653
Over 10 hp.	41	66,832	61	130,839	216	142,666
Automobile engines for:						
Motor trucks and buses	291	36,342	258	31,815	641	85,426
Passenger cars	1,306	92,050	552	57,345	1,037	92,050
Tractors	4	1,411	....	.....	2	1,007
Aircraft	14	18,678	45	194,112	15	112,127
Accessories and parts (carburetors)	....	115,038	....	108,769	....	180,566
IMPORTS						
Automobile chassis (dutiable)	34	41,279	56	48,676	40	15,474
Other vehicles and parts for them (dutiable)	....	1,871	....	4,855	....	2,807
REIMPORTS						
Automobiles (free from duty)	6	5,762	21	17,080	21	34,587

AC Canadian Plant Nearly Ready to Open

ST. CATHARINES, ONT., March 7—The AC Spark Plug Co. will start manufacturing activities in St. Catharines this month. Installation of plant equipment for producing spark plugs which has been under way for several months, is nearing completion and establishment of an all-Canadian sales organization with increased personnel has been effected. Activities will be in charge of Walter E. Richardson, who has been connected with AC Company in Canada for the past 12 years.

Studebaker Sales Up

CHICAGO, March 7—Studebaker Corp. sold more than 5000 passenger cars and trucks during February, A. R. Erskine, president, reports. This is 68 per cent above the total for January, and 13 per cent above February last year.

Chrysler Shipments Up

DETROIT, March 4—Chrysler Motors February shipments of Chrysler, Dodge, DeSoto and Plymouth cars to dealers were 36 per cent in excess of January shipments, according to a statement made by B. E. Hutchinson, vice-president and treasurer of the corporation. Shipments for the first two months this year are 101 per cent of the same period of 1931.

Blackhawk Names Watson

The Blackhawk Mfg. Company, Milwaukee, Wis., has announced the appointment of George M. Watson, as their representative throughout the Dominion of Canada.

Dodge Names Two

Russell Paige, general sales manager of Dodge Bros. (Canada) Limited and Plymouth Motor Corporation of Canada, Limited, has announced the appointment of Ralph A. Shelley as assistant general sales manager. Charles T. Smith has been appointed Dodge truck sales manager.

P-A Reports Loss

NEW YORK, March 7—Pierce-Arrow Motor Car Co. and subsidiaries report net loss for the year 1931 of $476,943. This compares with profit for the previous year of $1,317,070.

Twin Coach Completes Order

KENT, OHIO, March 7—The Twin Coach Co., has delivered the last of an order of 75 delivery units to the Golden State Company, of San Francisco, Calif. This makes a total of 150 delivery units of the Kent concern in operation for the California company.

Packard Shipments Jump

DETROIT, March 7—Packard shipments for February totaled 2150 units, an increase of 270 per cent over the previous February, according to a report by Packard Motor Car Co. Schedules for March, said the company, are to be maintained on the same basis as February, with banked-up shipping orders extending well into April.

Auburn Declares Dividend

AUBURN, IND., March 7—Auburn Automobile Co. announced today declaration of its regular dividend of $1 a share cash and the usual additional dividend of 2 per cent, payable in stock. The dividend voted is payable April 1, 1932, to stockholders of record at the close of business March 21, 1932.

British Cycle Production Drops 40% in 1931, to 74,000 Units

Motorcycle production in Great Britain declined by about 40 per cent in 1931 as compared with 1930, according to some figures published by *Engineering* of London. Great Britain has long been the leading producing country for motorcycles, its production having reached a peak value of 162,000 in 1927. The two following years the production ranged between 140,000 and 150,000 each year; in 1930 it dropped to 120,500 and in 1931 to 74,000.

Both the domestic and foreign markets decreased in 1931, but the shrinkage in exports accounted for the greater part in the loss of production. Domestic sales decreased roughly 30 per cent as compared with 1930, while foreign sales dropped 50 per cent from those of 1930, which year had shown a decrease of 30 per cent from the sales of 1929. Part of the decline is ascribed to the invasion of the field of the motorcycle by the light car, but it is felt that the chief cause of it has been the world-wide depression.

Declines in the exports of motorcycles were exceptionally great in the cases of Australia, New Zealand, Sweden, and Germany. The first mentioned country last year took less than one-tenth of its quota of 1929; exports to Sweden and New Zealand dropped roughly to one-fifth those of 1929, while exports to South Africa and Germany dropped to one-third. Exports to other countries decreased approximately one-third from the 1929 level. Imports of foreign-built motorcycles into Great Britain are negligible.

Exports of motorcycles from the five leading producing countries during the past four years are given in the table herewith. This table shows heavy declines for each country with the exception of Germany, and in the case of the latter country volume was maintained only by heavy price reductions as indicated by the fact that while Germany's share of the number of machines exported increased from 10.4 to 16.8 per cent of the total, its share in the aggregate value of motorcycles exported increased only from 11.0 to 14.4 per cent.

The experience of the British pedalcycle industry was similar to the motorcycle branch, its export markets also having contracted relatively more than the home market.

Exports of Motorcycles

Exported From	1928 No.	1928 Per Cent	1929 No.	1929 Per Cent	1930 No.	1930 Per Cent	1931 No.	1931 Per Cent
United Kingdom	59,904	59.9	62,428	60.1	42,689	58.8	23,900	54.9
Germany*	4,681	4.7	7,540	7.3	7,554	10.4	7,300	16.8
U.S.A.	18,934	19.9	16,265	15.6	10,262	14.1	5,400	12.4
France	6,970	7.0	6,978	6.7	5,702	7.8	3,964	9.1
Belgium	9,534	9.5	10,722	10.3	6,444	8.9	2,980	6.8
Total	100,023	100.0	103,933	100.0	72,651	100.0	43,544	100.0

Auto-Lite Reports Profit

NEW YORK, March 7—Electric Auto-Lite Co. and subsidiaries report net profit for 1931 of $3,913,833 after all charges. This is equivalent, after preferred dividends, to $4.03 a share on common stock, and compares with earnings of $5,043,402 or $5.32 for the previous year.

Transport Meeting for Toronto

TORONTO, ONT., March 7—At the last meeting of the Canadian section of the Society of Automotive Engineers it was announced by Alex McArthur, Toronto, immediate past chairman of the Canadian section of the Society, and general superintendent of the Toronto Transportation Commission, that the Transportation meeting of the S. A. E. would be held in Toronto in October next.

British Star Co. Fails

A receiver has been appointed on behalf of the debenture holders of the Star Motor Co., Ltd., of Wolverhampton, England. The company, which was registered as early as 1896 under the title of the Star Cycle Co., becoming in 1909 the Star Engineering Co., and taking on its present title in 1928, became associated with Guy Motors, well-known manufacturers of commercial vehicles, in 1930. The receivership, however, will not affect Guy Motors, as the value of their holdings in the Star company was written off nine months ago. The future of the Star company is uncertain, but it is hoped to continue the 1932 program. The authorized share capital is £172,000. The company manufactures six-cylinder passenger cars between the ranges of 14 and 24 hp. and £345 and £695.

Flays Increased Taxes

LANSING, March 9—Harry Harper, president, addressing stockholders at the annual Motor Wheel Corp. meeting here Tuesday, declared taxation is eating up profits. "Today, more than ever, taxation is increasingly taking what should be your profits, but which are instead devoted to tax payments. Every year the burden becomes heavier. It is high time that the trend of such costs be reversed. I believe it our duty to, in a most emphatic manner, advise those who represent us, that governmental costs must come down and be kept down to a reasonable level. Only when that is done can investors receive a full and fair return on their investments, and it won't be done unless we all demand it in terms that cannot be misunderstood," he said.

Officers and directors of the corporation were reelected. They are: Harry Harper, president and general manager; W. C. Brock, first vice-president; D. L. Porter, vice-president and treasurer; J. B. Siegfried, vice-president; Clarence C. Carlton, secretary. O. A. Jenison, H. W. Kranz, W. H. Newbrough, Ray Potter, and E. C. Shields, directors.

Overseas Club to Meet

NEW YORK, March 9—The March meeting of the Overseas Automotive Club will be held Tuesday noon, March 22, in conjunction with the annual get-together with the New York Export Managers Club at the Hotel Pennsylvania. The club will sponsor a group lunch of automotive, transportation and aeronautical fields.

Speakers will include Arvid L. Frank, vice-president and general manager, Studebaker and Pierce-Arrow Export Corp.; George F. Bauer, chairman of the executive committee of the World Trade League of the United States; Edgar W. Smith, member of the executive committee of this league, and Leighton Rogers of the Bureau of Foreign and Domestic Commerce, Washington.

Fiat Employees Take Wage Cut

It is reported from Turin that the workmen of the Fiat motor factory there have agreed to a 10 per cent reduction in wages as from March 1. The measure is intended to place the works in a better position to compete in foreign markets, and is thought to be required in particular to meet the advantages which British motor manufacturers have gained through their country's abandonment of the gold standard.

Business in Brief

Written by the Guaranty Trust Co., New York, exclusively for Automotive Industries

NEW YORK, March 9—Although optimism has been more prevalent, there has been no change in the actual level of trade. For the most part business has been quiet, with caution still the rule, especially in the heavy industries. Collections remained slow last week, but there was a reduction in the number of bank and retail failures. The country hopefully awaits the improvement that is expected to follow the recently enacted Government measures.

DEPARTMENT STORE SALES

The value of department store sales in the New York Federal Reserve district during January was 19 per cent below that in the corresponding period last year. Wholesale trade in this district was 21 per cent below that a year ago, and store chain sales 6.7 per cent below.

CAR LOADINGS

There was some improvement almost uninterrupted decline in in railway freight loadings during the week ended Feb. 20. The total of 572,606 cars marks an increase of 10,141 cars above that during the preceeding week, but a decrease of 140,550 cars below that a year ago and a decrease of 254,954 cars below that two years ago.

RETAIL FOOD PRICES

Retail food prices in the United States, according to a report of the Bureau of Labor Statistics, showed an average decrease of 4½ per cent during the month ended Jan. 15 and a decrease of 17⅞ per cent during the year ended Jan. 15, 1932.

CRUDE OIL OUTPUT

Average daily crude oil production for the week ended Feb. 27 amounted to 2,138,050 bbl., as against 2,108,050 bbl. for the preceding week and 2,100,900 bbl. for a year ago.

FISHER'S INDEX

There has been no check to the Professor Fisher's index of wholesale commodity prices. The index for the week ended March 5 stood at 62.9, as against 63.7 for both the week and two weeks before.

BANK DEBITS

Bank debits to individual accounts outside of New York City during the week ended March 2 were 33 per cent below those in the coresponding period last year.

STOCK MARKET

There were no spectacular developments in the stock market last week. There was some recession during the first two days, but a strengthening tendency developed during the remainder of that period. The volume of trading was only moderate, but there was some increase as the market improved. General prices showed slight net gains for the week.

RESERVE STATEMENT

The consolidated statement of the Federal Reserve banks for the week ended March 2 showed decreases of $7,000,000 in holdings of discounted bills, and of $17,000,000 in holdings of bills bought in the open market. Holdings of Government securities increased $19,000,000. The reserve ratio on March 2 was 68.1 per cent, as against 68.0 per cent a week earlier and 67.4 per cent two weeks earlier.

Heads Pontiac Parts, Service

DETROIT, March 8—T. W. Moss has been appointed parts and service manager for Pontiac, succeeding J. S. O'Rourke, who resigned. Moss was formerly with Chevrolet for 10 years. He was successively parts warehouse manager for Chevrolet of Canada, service manager of Detroit retail store, parts and service manager for Detroit zone and for the last two years was with the central office, specializing on service and reconditioning used cars.

Seeks New Plant Site

MILWAUKEE, March 7—The Aerocar Co. of Detroit, Inc., Detroit, Mich., is negotiating with the new-industries division of the Milwaukee Association of Commerce with a view of relocating its plant, mainly to effect savings in being closer to the Sitka spruce supply on the Pacific coast. The concern manufactures large "land yachts," ambulance and clinic cars, sales display coaches and moving and horse vans, and trailers for passenger car application.

Allis Industrial Sales Up

MILWAUKEE, March 7—Sales of Allis-Chalmers industrial tractors so far this year are nearly five times as large as in the same period of 1931, it is announced by H. C. Merritt, manager of the tractor division of the Allis-Chalmers Mfg. Co. The plant in Springfield, Ill., where large crawler and industrial tractors are manufactured is now on a 6-day week. The outlook for agricultural tractors is considered better than last year.

Gillette Curtails Output

EAU CLAIRE, WIS., March 7—The Gillette Rubber Co. here has discontinued for the time being the manufacture of U. S. brand tires for new car equipment, it is announced. Shipment of some of these molds led to rumors that the plant was being dismantled, causing considerable concern to business men and employees and leading to the announcement. There has been some curtailment of output, due largely to the fact that March orders from Montgomery Ward & Co., Chicago, were reduced following a heavy demand in December and January.

Gear Makers to Meet

CLEVELAND, March 7—The sixteenth annual meeting of the American Gear Manufacturers Association will be held at the Hotel Stadtler here May 12 and 13. A meeting of the executive committee of the association will be held at the same place on May 11. The general meeting has thus been reduced from the usual three days to two days.

Reeves Visits Toronto Show

Tells N. A. C. C. of Larger Dominion Place in Vehicle World

TORONTO, March 9—Canada is destined to figure very prominently in the future expansion of the automotive industry, Alfred Reeves, vice-president and general manager of the National Automobile Chamber of Commerce, told the Canadian Automobile Chamber of Commerce at its Toronto Show Banquet last evening.

After complimenting the Canadian chamber on the show and upon their holding it at the time when all manufacturers have their 1932 models ready, Mr. Reeves discussed the future of Canada, not only as a user of automobiles and a producer of raw materials, but also as a manufacturer of completed vehicles.

"This circumstance suggests that Canada should share with the United States the task of teaching the people of other nations the benefits to be derived from highway transportation," Mr. Reeves said. "Canada's great future rests largely upon its transport facilities. Government officials should encourage travel by making it as free as possible from restriction."

The bus, truck and airplane as feeders to the railroads require certain forms of regulation and not strangulation, he pointed out.

Borg-Warner Profits

NEW YORK, March 8—Borg-Warner Corp. and subsidiaries report net income for 1931 of $208,209 after all charges, including obsolescence, plant removal, etc. This is equivalent, after preferred dividends, to 81 cents a share on common stock and compares with earnings of $2,318,120, or $1.66 a share for the previous year.

Mack Declares Dividend

NEW YORK, March 8—Mack Trucks, Inc., have declared quarterly dividend at 25 cents a share, payable March 31 to stockholders of record March 18.

A.C.C. Moves Offices

NEW YORK, March 8—Aeronautical Chamber of Commerce of America, Inc., has moved its headquarters from the former location at 10 East Fortieth Street, to new offices at 22 East Fortieth Street.

Campbell Sails for Europe

Sir Malcolm Campbell, who set a new world's land speed record of 253.968 m.p.h. at Daytona Beach on Feb. 24 in his Napier-powered "Blue Bird," sailed for England March 4 on the Berengaria.

Hoist and Capstan Designed for Trucks

Dr. Ing. F. Belt of Graz, Austria, has recently come to this country to introduce his hoist and capstan device. The latter is used particularly in connection with motor vehicles operating in difficult territory, where the vehicle may become stalled and unable to proceed under its own power. The Haardt expedition to Asia, for instance, to which reference was made in a recent issue of *Automotive Industries*, carried a number of these capstans.

The most interesting feature of the Titan capstan is the anchoring device. This consists of light steel units held in place by long steel pegs which are driven into the ground at an inclination to the vertical. This anchoring device is said to hold in all kinds of soil. By using a suitable number of units and pegs, the holding power can be carried as high as 100,000 lb.

Upon this anchorage is set a small capstan drum, the axis of which can be inclined to the vertical. For further multiplication of the effort exerted upon the capstan bar a block and tackle are inserted in the line between the capstan and the load to be moved. the outfit is made in various capacities and what is designated the 5-ton unit is said to make it possible for one man to exert a pull of 10,000 lb. at the end of the cable.

These pulling devices, of course, have a much wider application than merely in connection with stalled motor vehicles. They are being used at present also by street car lines, fire departments, army administrations, steamship companies, heavy horse transport undertakings, telephone companies (in erecting poles), construction companies, bridge builders, etc. They lend themselves also to use in pulling stumps.

While in this country, Mr. Belt is located at 356 West Thirty-fourth St., New York.

Curtiss-Wright Adds Plane

NEW YORK, March 7 — Curtiss-Wright Corp. will offer at the Detroit Aircraft Show, April 3 to 10, a new three-place biplane called the Light Sport. This plane, powered with a Wright 165-hp. engine, has a cruising speed of 110 miles an hour, consumes eight gallons gas per hour, with a comparably low oil consumption.

Top speed is 135 miles an hour, and landing speed 48 miles an hour. The new plane has a ceiling of 18,000 ft. and a rate of climbing of 1100 ft. per minute.

Kades Organization Files

BELOIT, WIS., March 7—Articles of incorporation have been filed in behalf of the Kades Motor Parts Co., which is establishing a plant for the manufacture of automotive parts, equipment, tools and accessories. The principals are represented by Stephens, Sletteland & Sutherland, attorneys, Madison, Wis.

Twin Disc Adds Customers

RACINE, WIS., March 7—The Twin Disc Clutch Co., manufacturing clutches for trucks, tractors, machine tools, etc., reports an increase of 31 per cent in its customer list during the past eight to twelve months.

Adds Air-Horn Line

TOLEDO, March 7—A new electric air horn, known as the MotoVox electric air trumpet, has been placed on the market by the Moto Meter Gauge and Equipment Corp. MotoVox electric air trumpets are made in two sizes and are furnished in matched tone pairs for twin installation at the front of the car on opposite sides of the radiator. The action of the horn is said to be based on a new principle, an air stream produced by an electrically vibrated diaphragm being synchronously modulated by means of a vibrating valve and then forced into a trumpet resonator.

Making Power Lawn Mower

MILWAUKEE, March 7—The Outboard Motors Corp., 4143 North Twenty-seventh St., which recently announced addition of a bicycle-propelling unit to its line, is now entering production on a power lawn mower as a further extension of its activities.

Battery Makers Report Profit

NEW YORK, March 7—Electric Storage Battery Co. and Willard Storage Battery Co. report net profit for 1931 of $2,770,457. This is equivalent to $3.05 a share on combined common and preferred stocks, and compares with earnings of $5,647,300 or $6.22 a share for previous years.

Worthington Reports Loss

NEW YORK, March 7—Worthington Pump & Machinery Corp. reports net loss for 1931 of $660,158. This compares with a profit for the previous year of $2,056,093 or $8.23 a share on common stock, after preferred dividends.

Motor Products Loss

DETROIT, March 7—Motor Products Corp. has reported net loss of $18,461 for year ended Dec. 31, 1931, after all charges and depreciation, against a net income of $487,139 in the previous year.

Steel Mills Push on Prices

Attempt Stabilization Upward, With Few Buyers' Contracts in Force

NEW YORK, March 10—Efforts on the part of steel producers to "stabilize" prices on a somewhat higher basis than that which has prevailed of late continue unabated. It is pointed out that only a very few consumers have contract protection at this time and that, with the exception of these, sellers are free to revise quotations upward on the day-to-day run of incoming business as well as on what few inquiries for second-quarter prices are received.

Steel bars are now quoted at 1.60 cents, Pittsburgh; 1.65 cents, Cleveland, and 1.70 cents, Chicago, an advance of approximately $2 per ton. Sellers of steel bars are in somewhat more favorable position when it comes to eliminating irregularities than are makers of the lighter rolled products.

Upward revision of prices for sheets is on the program, but is not being quite so energetically pushed as in other lines. Very little is heard about the new 2.90 cents, Pittsburgh, price for automobile sheets. Demand has been extraordinarily light of late and there has been no opportunity for testing the new price which denotes a $2 per ton advance. Following announcement of a $2 per ton advance in cold-rolled strip prices, it is now the objective of sellers to bring about an advance to the same extent in prices for the hot-rolled product. Very little business has been placed so far at the advance in the cold-rolled. More sheet mills went into operation this week in the Youngstown district and the recent rate of light operations is well maintained.

Pig Iron — Shipments to automotive foundries continue at a fair rate, but fresh commitments are still confined to single car lots. Prices remain unchanged.

Aluminum—Middle West sellers of secondary metal report a fairly steady demand from accessories foundries. The supply of scrap is on the increase. Conditions in the virgin metal market continue quiet along routine lines.

Copper—While foreign buying at somewhat better prices has not been without its favorable effect on the sentiment of domestic consumers, their actual interest in offerings is still in abeyance. The market is nominally quoted at 6½ cents, Connecticut Valley, with custom smelters inclined to shade this figure fractionally if any business were offered.

Tin—Advances in the Sterling exchange market caused tin prices to hold their own in spite of dips in London Metal Exchange quotations, Straits being quoted at the beginning of the week at 22.30 cents.

Lead—Quiet and firm.

Zinc—Steady and quiet.

Toledo Plants Add Men

TOLEDO, March 7—Toledo automotive plants reported gain of about 450 workmen in the last week.

Wayne Co. Sales Hopeful in Tone

Show Increase Over Those for February Last Year

DETROIT, March 9—Wayne county February registrations show a distinctly hopeful note with an increase of nearly 26 per cent over January. While the total of 2555 is 36 per cent below February last year, elimination of Ford actually shows a gain over that month of 4 per cent. With Ford omitted, February, 1932, is 65 per cent ahead of January.

Chevrolet continues to lead with 710, well ahead of last year, with Essex in second place with 242. Ford registered only 205, compared with 1727 last February. The largest proportionate gain was made by DeSoto with 129 cars, more than five times last February volume. Chrysler sales also more than doubled its volume to date in Wayne county to take fourth place. The only manufacturer in production to show serious loss of business is Willys-Overland with 42 cars against 391 for February last year.

With the exception of Packard, all members of the high-priced group showed substantial gains over last year. Cadillac-LaSalle reports total February shipments of 2058, an increase of 26 per cent over last year with deliveries for February approximately 16 per cent ahead. As compared with January sales they are 63 per cent ahead.

Des Moines Attendance Up

DES MOINES, IOWA, March 7—Attendance increase of 14 per cent over last year with sales of about 90 vehicles from the floor were high spots of the recent twenty-third annual auto show in the Coliseum sponsored by the Des Moines Automotive Merchants Association. Dean Schooler and C. G. VanVliet, managers of the show, said it was the most successful in point of sales, attendance and buyer reaction, in the association's history. Forty-two sales of models shown at the show were delivered within the week and show sales were valued at $75,000. One dealer reported that his sales in the four days exceeded any two months' business in 1931.

DeSoto Shipments Gain

DETROIT, March 8—DeSoto Motor Corp. has announced that February shipments of the new DeSoto Six showed a 95 per cent gain over February last year. Last month's shipments totaled 4452, as compared with 2282 for February, 1931. Early March reports from dealers indicate that this month will top the February showing.

In issuing the statement, Byron C. Foy, president, pointed out that retail deliveries are showing a substantial gain over last year. "The third week in February showed a 69.5 per cent gain over the corresponding week of last year and the fourth week went even bigger with a 75 per cent increase over that week of last year," Mr. Foy said.

A. Kenneth Mayer

PEORIA, ILL., March 8—A. Kenneth Mayer, aged 37 years, export credit manager of the Caterpillar Tractor Co., Peoria, Ill., died Feb. 25 in a Peoria hospital after a few days' illness of pneumonia. He had been assistant treasurer of the Western Harvester Company several years before joining the Caterpillar concern and coming to Peoria 17 months ago. He was a native of Kingston, N. Y.

Van Sicklen Resigns

Norton H. Van Sicklen, Jr., for the past two years president of the Van Sicklen Corp., Elgin, Ill., manufacturers of automobile accessories and leather novelty goods, has resigned his executive position and as a director of the corporation. L. N. Duryea, vice-president, is in charge of the business, which will be continued as in the past. No other changes in the official personnel have been made, R. L. Corey continuing as vice-president and treasurer; J. W. Eckelberry as secretary, and P. G. Brown, assistant secretary-treasurer.

L. A. Young Reports Profit

DETROIT, March 7—L. A. Young Spring & Wire Corp. and subsidiaries has reported net profit for year ended Dec. 31, 1931, of $521,738 against a net profit for the previous year of $1,295,375.

The board of directors declared a dividend of 25 cents payable April 1, to stock of record March 15.

Audet Rejoins Greenfield

H. R. Audet has been appointed Michigan manager for the Greenfield Tap and Die Corp. He was formerly a division manager for the General Motors Export Co., and had previously been connected with the Greenfield Tap and Die Corp. and the Geometric Tool Co.

Willys Reports Loss

TOLEDO, March 8—Willys-Overland sold 61,782 cars and trucks for $38,384,323 during 1931 which gave the company a loss of $646,052 after all charges except depreciation and $1,892,260 after amortization and depreciation, it was reported by L. A. Miller, president, today.

Special chargeoffs amounting to $12,128,984 were made to plant, equipment, inventory, investments in affiliated companies, for extraordinary advertising, and miscellaneous notes and accounts so that surplus was reduced $14,021,244 to total $7,027,713. During the year preferred dividends amounting to $456,459 were paid and $805,000 of preferred stock was purchased for retirement at a discount of $407,541.

The usual $1,000,000 worth of bonds were retired, leaving $2,000,000 outstanding.

Balance sheet shows cash $1,381,592, inventory $5,670,685 and plant and equipment reduced to $31,645,438. Current assets were $7,944,741 against current liabilities of $3,123,973.

President Miller said conservative values are now placed on all accounts and ample reserves set up for all contingencies. Further operating economies have been made.

Bendix Earnings Show Increase

Earnings for 1931 Will Reach 88 Cents a Share, Buettner Says

CHICAGO, March 7—Annual report of Bendix Aviation Corp. for 1931, available about March 19, will show net income of $1,785,479, equal to 85 cents a share on 2,097,663 common, according to Walter J. Buettner, treasurer. This compares with net income of $1,183,860, or 56 cents a common share in 1930.

Earnings for 1931 include some non-recurring income. In this connection it was learned that full year's figures include only the $411,000 non-recurring credit which was shown in report for first nine months of year.

In 1931, with shrinkage of 21 per cent in sales volume, resulting principally from curtailed activity of the automobile industry, net operating income, excluding non-recurring items, increased 12 per cent, Mr. Buettner said.

"We are convinced that in the current year we will show an increase in both gross and net over last year, due to new business we have received and also to extensive eliminations of overhead recently accomplished."

Company reports 2,097,663 common shares are currently held by approximately 20,000 stockholders.

Marlin Rockwell Reports Loss

NEW YORK, March 7—Marlin Rockwell Corp. reports net loss for 1931 of $23,052 after a loss of $122,402 on the sale of capital assets. This compares with a profit of $922,171 or $2.53 a share for the previous year.

J. B. Flick

DETROIT, March 8—J. B. Flick, 63 years old, president of Universal Products Co., Inc., died yesterday in Grace Hospital following an illness of two weeks.

G. M. Sales Drop in February

Shipments to Consumers Total 46,855 in the Month

NEW YORK, March 8—February sales of General Motors cars to consumers in the United States totaled 46,855 as against 68,976 for the corresponding month a year ago.

February sales of General Motors cars to dealers in the United States totaled 52,539 as against 80,373 for the corresponding month a year ago.

February sales of General Motors cars to dealers in the United States and Canada, together with shipments overseas, totaled 62,850 as against 96,003 for the corresponding month a year ago.

G. M. SALES TO CONSUMERS IN UNITED STATES

	1932	1931	1930	1929
January	47,942	61,566	74,167	73,989
February	46,855	68,976	88,742	110,148

G. M. SALES TO DEALERS IN UNITED STATES

	1932	1931	1930	1929
January	65,382	76,681	94,458	95,441
February	52,539	80,373	110,904	141,222

G. M. TOTAL SALES TO DEALERS IN U. S. AND CANADA PLUS OVERSEAS SHIPMENTS

	1932	1931	1930	1929
January	74,710	89,349	106,509	127,580
February	62,850	96,003	126,196	175,148

Unit sales of Chevrolet, Pontiac, Oldsmobile, Buick, LaSalle and Cadillac passenger and commercial cars are included in the above figures.

Studebaker Exports Up

SOUTH BEND, IND., March 7—February shipments of Studebaker, Pierce-Arrow and Rockne passenger cars and trucks to dealers in markets outside of the United States exceeded the total for February, 1930, and were 28 per cent ahead of February, 1931, according to a statement made today by Arvid L. Frank, vice-president and general manager of The Studebaker Pierce-Arrow Export Corp.

Charles F. Beckwith

NEW YORK, March 7—Charles F. Beckwith, for approximately 15 years representative of *Automotive Industries* in New England, died at his home in Hartford, Conn., Feb. 25. Mr. Beckwith, who had been ill for two or three years, died as the result of a stroke.

Papers Filed For Continental-DeVaux

DETROIT, March 8—Articles making the Continental-DeVaux Co. a corporation were filed March 5, in Lansing, Mich. This new company, a division of Continental Motors Corp., will be the manufacturers and sellers of the DeVaux automobile with the main plant in Grand Rapids.

The capitalization of the company calls for 10,000 shares of preferred stock with a par value of $100 per share and 300,000 shares of no par common stock.

Directors of the Continental-DeVaux Co. are W. R. Angell, Roger Sherman, F. F. Beall, Craig Keith and Wallace Zwiener.

The Michigan assets and the business of the DeVaux Company were purchased by Continental Motors Corp., on Feb. 18. Rapid progress has been made by Continental officials, and production of the Model 80 DeVaux is announced to begin on April 1.

Graham Offers Options

DETROIT, March 7—Graham-Paige Motors Corp. has notified its dealers that they may now order either standard or de luxe Graham eights with a combination of special equipment that includes chromium-plated wire wheels, head lamps, tail lamps, and running board kick plate molding, with a special radiator ornament, front compartment carpet, and rear seat pillow.

Dealer orders for chromium wire wheels without the other special equipment also will be filled on dealer orders. Other single items of the special equipment list may be ordered from the Service Accessory Department.

Studebaker Branch Sets Record

NEW YORK, March 7—Studebaker Corp. of New York sold 425 new cars in the boroughs of Manhattan, Bronx, Kings and Queens during January, according to C. K. Whittaker, New York branch sales manager. This is the largest number of cars delivered in any previous January in the history of the New York branch.

Develops New Fan Belt

AKRON, March 8—The B. F. Goodrich Co. has developed a high-speed fan belt which has passed tests up to 5000 r.p.m.

To produce this belt it was necessary to design a new dynamometer set and a new line of machines, according to J. H. Connors, Goodrich vice-president, who made the announcement.

William H. Mullins

SALEM, OHIO, March 7—William H. Mullins, 76, millionaire automotive manufacturer, who gave a large part of his fortune to charity, died Sunday, March 6, at his home here following a lingering illness.

The Mullins Manufacturing Corp., headed by Mr. Mullins, was founded in 1882 when he was 26. In 1890 he bought out his partners' interest.

The company first engaged in metal stamping and art metal work. In 1905 the stamping of steel bodies for automobiles was started. Later products were made from new alloys, including radiators for Packard and other leading automobile manufacturers. Mr. Mullins had been in ill health for four years, and eight years ago retired from active management of the company.

Joint Meeting On Testing Set

Three Technical Societies Sponsor Detroit Session

DETROIT, March 7—Seven prominent executives and engineers are to discuss various aspects of service testing of automotive products and correlation with laboratory tests at a joint meeting in Detroit on Monday evening, March 28, under the auspices of the A.S.T.M. Detroit District Committee and the Detroit chapters of the A.S.S.T. and the S.A.E. This meeting will be held in the Fort Shelby Hotel and will be preceded by a dinner beginning at 6.15 p. m. The program follows:

"Introduction," F. O. Clements, technical director, research laboratories, General Motors Corp., president, American Society for Testing Materials.

"Road Testing of the Entire Automobile," A. J. Schamehorn, director, General Motors Proving Ground.

"Destructive Testing of Automotive Products," J. M. Watson, metallurgical engineer, Hupp Motor Car Corp., past president, American Society for Steel Treating.

"Service Complaints on Automobiles as Related to Engineering Tests," Nicholas Dreystadt, general service manager, Cadillac Motor Car Co.

"Relation of Service Testing to Metallurgy of Automobile Parts," J. L. McCloud, metallurgist, Ford Motor Co.

"Service Tests of Automobile Fuels and Lubricants," D. P. Barnard, research engineer, Standard Oil Co. (Indiana).

"Service Testing of Automobile Tires," S. M. Cadwell, in charge of tire development, U. S. Rubber Co.

Noblitt Passes Dividend

CHICAGO, March 7—Quarterly dividend of 40 cents, due April 1 on Noblitt-Sparks Industries common, has been omitted. This action was anticipated, reports having indicated annual report will show net loss for 1931 of approximately $100,000.

Graham Reports Loss

DETROIT, March 8—Graham-Paige and subsidiaries report net loss for last year of $4,735,926 after all charges against net loss of $4,969,320 in previous year.

Studebaker Earns 20c. Per Share

Reduction in Par Value of Capital Stock is Proposed

NEW YORK, March 7—Studebaker Corp. and subsidiaries, including Pierce-Arrow Motor Car Co., report net profit for 1931 of $825,202. This is equivalent, after adjustment of Pierce-Arrow minority interest and preferred dividends on Studebaker, to 20 cents a share on common stock, and compares with earnings of $1,540,202 or 27 cents a share for the previous year.

A. R. Erskine, president, in publishing the financial report, outlines a plan for reorganization of the stock to be submitted at a stockholders' meeting, April 26. Under this plan, the par value of capital stock would be reduced from $40 to $20 a share, and the corresponding amount written off from the capital account and added to the surplus account. A portion of this additional amount added to the surplus account would be used in writing down the trade name, good will and patent rights account from the present figure of $19,807,276 to $1. This write-down would take place in the stock capitalized at the time of payment of stock dividends paid in 1920, 1922 and 1929.

1931 Tire Sales Dropped

NEW YORK, March 7—Total sales of tires and tire sundries during 1931 amounted to $402,927,000, according to the statistics prepared by the Rubber Manufacturers Association from its quarterly questionnaire. This compares with $518,786,000 for the previous year, and contributed to the total for the complete rubber industry of $612,577,000, as compared with $803,128,000 for the previous year.

Crude rubber consumed in the manufacture of tires and tire sundries during the year was 260,516 long tons, as compared with 208,989 for the previous year. Total crude rubber consumed by the entire industry was 318,949 long tons, as compared with 341,430 for the previous year.

Chevrolet Fleet Sales Up

DETROIT, March 7—A gain of 81 per cent was registered by Chevrolet Motor Co. during January in fleet deliveries of cars and trucks over the same month last year, according to H. J. Klingler, vice-president and general sales manager.

Bohn Reports Profit

DETROIT, March 7—Bohn Aluminum & Brass Corp. has reported net profit of $295,333 after all charges, equal to 84 cents a share on 352,418 no par shares capital stock, compared with a net profit of $724,359 or $2.05 a share in the previous year.

Current assets as of Dec. 31 last totaled $4,986,812 against current liabilities of $325,002, a ratio of better than 15 to 1.

The board of directors have deferred action on the dividend due at the present time.

Sets Up Canadian Sales Organization

CINCINNATI, March 5—A new division to handle sales activities in Canada, has been created by Aluminum Industries, Inc., under direction of R. H. Pardo. Steady growth in demand for Permite products throughout the Dominion necessitates this move.

Joint Show Group Named

NEW YORK, March 7—Motor and Equipment Manufacturers Association and the National Standard Parts Association have settled upon Detroit as the location of their third annual joint trade show to be held the week of Dec. 5. This show will be held in Convention Hall. All arrangements for the show will be handled by a joint operating committee.

M.E.M.A. representatives on this committee will be M. C. DeWitt, Champion Spark Plug Co., Toledo, Ohio; W. C. Allen, Black & Decker Mfg. Co., Towson, Md., and E. T. Satchell, Motor Accessories Co., Allentown, Pa., and another jobber.

N.S.P.A. representatives will be D. Rosenbach, W. D. Foreman Co., Chicago; L. A. Dall, Dall-Norton Parts Co., Cleveland; V. C. Anderson, Motor & Axle Parts Co., Chicago, and W. F. Burrer, Aberdeen Motor Supply Co., Cleveland.

Sues Moon Officers

ST. LOUIS, March 8—Seneca C. Taylor, receiver of the Moon Motor Car Co., filed suit in Circuit Court yesterday against five former officers of the company for an accounting. He alleged that as members of the board of directors they, without authority, paid to Carl W. Burst, who was president, a total of $26,000 as overdue salary between Aug. 2, 1929, and Jan. 1, 1930. Mr. Taylor, who was appointed receiver Dec. 2, 1930, asserts the payment was without consideration. The defendants are C. W. Burst, William D. Hemenway, vice-president; Stanley Moon, secretary; Henry W. Klemme, treasurer, and John J. Dornseif, auditor. Mr. Burst declined to comment on the suit.

Federal-Mogul Loses

DETROIT, March 7—Federal-Mogul Corp. and subsidiaries have reported for year ended Dec. 31, 1931, net loss of $83,420 after all charges, against a net profit of $84,452 in 1930.

Current assets as of Dec. 31, 1931, totaled $786,082 and current liabilities $250,109, including $65,000 6 per cent serial debenture notes due April 1, 1932.

McCord Reports Loss

DETROIT, March 7—McCord Radiator & Mfg. and subsidiaries have reported a net loss of $283,949 for year ended Dec. 31, 1931, against net income for previous year of $10,807.

+ + CALENDAR OF COMING EVENTS + +

SHOWS

Berne, Switzerland, Automobile..Mar. 11-20
National Aircraft, Detroit, Mich..Apr. 2-10

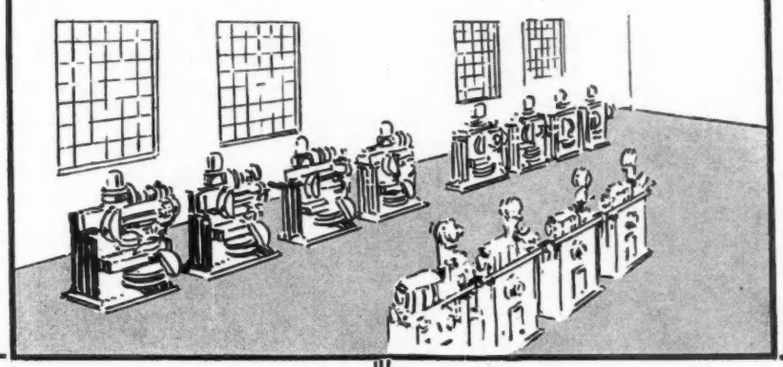
FOREIGN SHOWS

Lyons, France, Passenger and Commercial .....Mar. 7-20
Geneva, Switzerland, Passenger and Commercial .....Mar. 11-20
Vienna, Passenger and Commercial .....Mar. 13-20
Tel Aviv, Palestine (Levant Fair) .....April 7-30
Milan, International Automobile Salon .....April 12-27
Zagreb, Jugoslavia, Automobile Salon .....April 23-May 2
Peznan, Poland, International Fair .....May 1- 8
Dublin, Commercial .....May 4- 7
Budapest, International Fair...May 7-16
Belfast, Commercial .....May 25-28
Bordeaux, Fair .....June
Cork, Commercial .....June
Inverness, Commercial .....June 21-24
Southampton, Commercial .....July 5- 9
Llandrindod, Wales, Commercial .....July 20-22
London, Olympia Show .....Oct. 13-22
Glasgow, Scottish Motor Show..Nov. 11-19

CONVENTIONS

American Railway Asso., Chicago .....March 15-17
Southern Automotive Jobbers Asso., Atlanta, Ga. .....Mar. 16-19
Society of Automotive Engineers (Aeronautic Meeting), Detroit..April 5-6
American Welding Society, Annual Meeting, New York City.....Apr. 27-29
American Society Mechanical Engineering (Management Div.) Philadelphia .....May 2-6
American Gear Manufacturers Asso., Sixteenth Annual Meeting, Cleveland .....May 12-13
U. S. Chamber of Commerce, San Francisco, Calif.....May 16-20
National Battery Mfrs. Asso., Chicago, Ill. .....May 19-20
American Society Mec. Eng.(Natl. Aeronautic Meeting) Buffalo..June 6-8
American Society Mec. Eng.(Natl. Oil & Gas Meeting) State College, Pa. .....June 8-11
National Safety Council, Washington, D. C. .....Oct. 3-7

. . . . . *and think of the burden in fixed charges on the investment in housing your gear production when you might . . . . . .*



Economical Use of Floor Space

Indicates Good Management

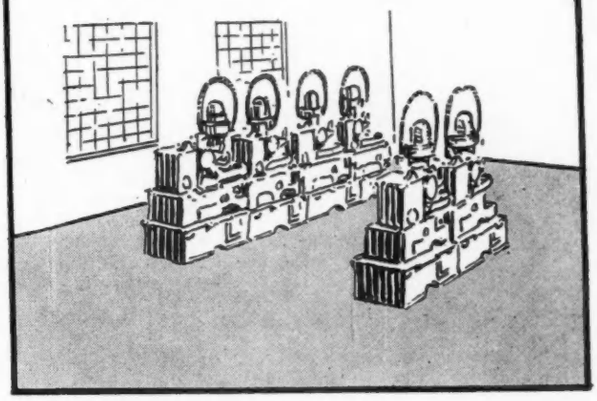
The difference between a profit and loss can hinge on the economical use of floor space. A consolidation of departments to reduce fixed charges lowers your production costs to that extent.

Coupled with a reduction in the amount of space occupied, the High Speed Gear Shaper will also improve the quality of your gears, and increase your production per man and machine.

The time to modernize your equipment is now. Next year it may be too late.

Ask to have a Fellows Engineer call and discuss this matter with you. Write: THE FELLOWS GEAR SHAPER COMPANY, 78 River Street, Springfield, Vermont; 616 Fisher Building, Detroit, Michigan.

. . . *re-equip with more modern machine tools and save 25% of the space*



The High Speed Gear Shaper will give you the same production in one-third less floor space.

FELLOWS
GEAR SHAPERS

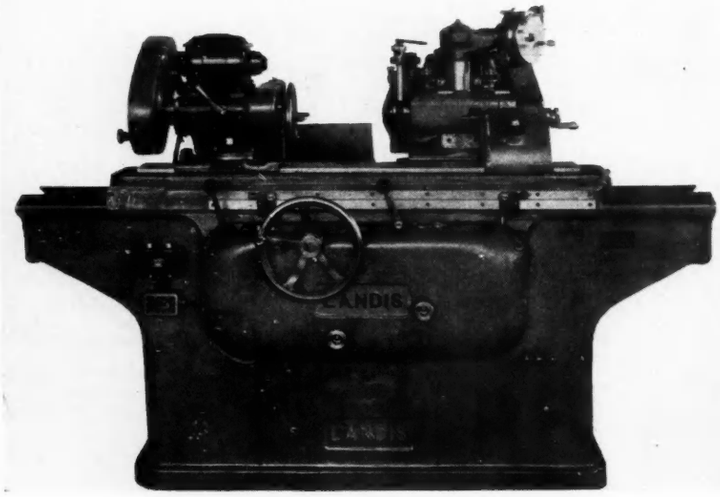
NEW DEVELOPMENTS

Automotive Parts, Accessories and Production Tools

10 in. x 24 in. Landis Universal Grinder

A 10 in. x 24 in. Hydraulic Universal Grinder has been developed by the Landis Tool Co., Waynesboro, Pa., for lighter production jobs of a great variety and for tool room work as well. An outstanding feature is the hydraulic table traversal which gives a range of table speeds from 6 in. to 144 in. per minute with smoothness and ease of control.

The work carriage traverses on a flat guide and a vee guide with one vertical side. Alignment is thereby easily maintained. Guide way lubrication is of the flood type, filtered oil being used and being supplied by the same pump which furnishes pressure for the hydraulic system.



The grinding wheel head is supported by a slide having a V and a flat guide with chilled surfaces. Steel back babbitt wheel spindle bearings are used. Control of the motor is from the front of the bed through the medium of a push button. Standard equipment includes both a 10 in. and 12 in. diameter wheel. The wheel head may be swiveled on its slide thus permitting the wheel to be set at various angles without influencing the direction of the feeding movement.

The hydraulic system consists of a twin cylinder type table traversing mechanism and a Tuthill internal geared oil pump. Because of the use of twin cylinders (one for movement in one direction, the other for movement in the reverse direction) the volume of oil in them is constant regardless of the direction of the traversal.

A plain wheel feed is considered standard. Final movement is transmitted through a pinion and rack with the Landis worm and worm gear arrangement at the rear of the feed up arm. Back lash is taken up by a long compression spring located beneath the base and quite accessible. At extra cost, a hydraulic automatic wheel feed mechanism will be supplied.

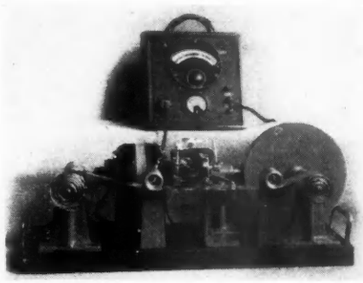
The headstock is driven by an individual constant speed motor which is controlled through a limit switch by the stop and start lever. A flat leather belt transmits the power from the motor to a jack shaft at the front of the base. Six work speeds are available by changing the pulleys and belts at the left-hand end of the head.

A ball bearing type internal fixture is supplied. It is mounted on the front of the wheel being driven by a flexible canvas belt from a pulley attached to the regular wheel spindle driving pulley on the motor. A hand reversing switch reverses the direction of the motor rotation for internal grinding.

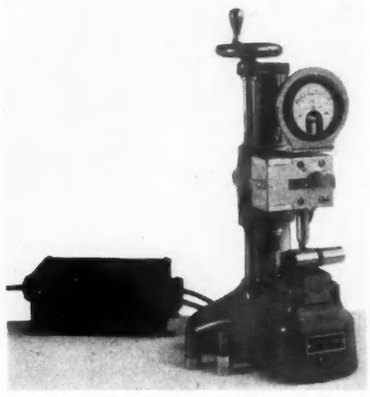
Net weight of the machine, without electric motors but with all standard equipment, is 3890 lb. All of the motors are of the constant speed type, the work drive being 1/3 hp., the pump drive ¾ hp. and the wheel spindle drive 1½ hp. Floor space required by the machine is 64 x 96 in.

P. & W. Electrolimit Gage for "Continuous Inspection"

In the rolling of strip and sheet stock, foil, wire, paper, etc., it is necessary that the size of the material being produced be known to the operator at all times in order that adjustments may be made while the work is in process, to maintain uniformity. Such an inspection usually must be made without shutting down the mill. This new application of Electrolimit Gage made by the Pratt & Whitney Co., Hartford, Conn., meets those conditions. The process is known as "continuous inspection."



The illustrations show a working model of the output of a foil mill, with the Electrolimit Gage mounted in the center between the idler pulleys. The motor moves the foil from left to right thru the gage, in the same way that the foil would come from the mill.



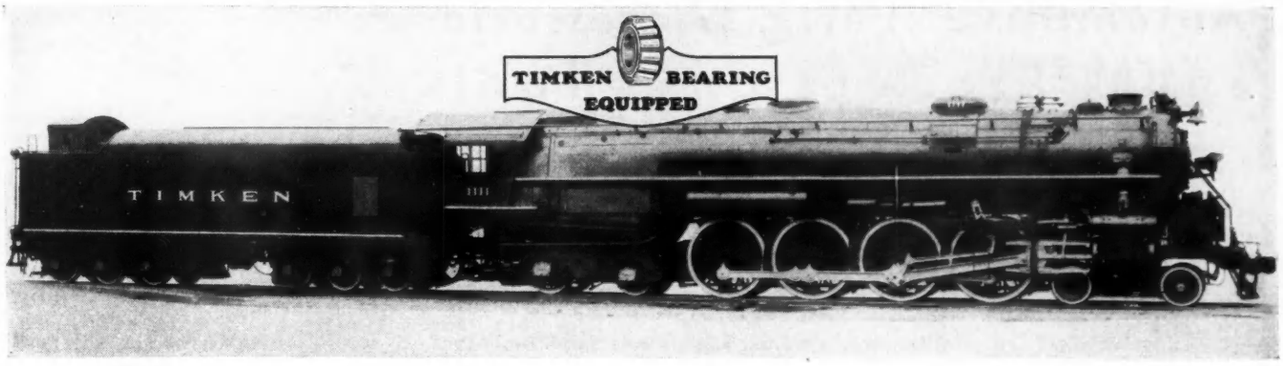
Any change in thickness of the material is transmitted mechanically to the gage, and then is magnified through the electric circuit and shown in easily readable form on the indicating dials.

Lufkin Announces "Crescent Junior"

The "Crescent Junior," a smaller and lighter weight tape-rule, is announced by The Lufkin Rule Co., Saginaw, Mich. It is a counterpart of the popular "Crescent" and is another practical combination of the utility of a

(Turn to page 442, please)

THE TIMKEN LOCOMOTIVE



100,000 miles without bearing trouble

A revolutionary accomplishment in locomotive operation

Again Timken has successfully pioneered a great forward step in anti-frictionization, and as a result, another important chapter has been added to the history of railroad development.

The Timken Locomotive was the first locomotive in the world to be completely equipped with anti-friction bearings on all axles—leading truck, driving wheels, trailer truck and tender trucks.

It was built by Timken to demonstrate the advantages of Timken Bearings in locomotive operation, and was placed in service on April 15, 1930. In January this year, the Timken Locomotive completed its official service test of 100,000 miles. This mileage was made on 14 railroads in regular passenger and freight service, and under every conceivable running condition.

Tough as locomotive operation is on bearings, the Timken Bearings in the Timken Locomotive have given no trouble whatever. No bearing repairs or replacements have been made.

Railroad master mechanics and engine foremen know what this remarkable performance means. They will tell you of the tremendous savings it will effect in locomotive maintenance . . . the dependability it assures.

It may seem a far cry from locomotives to automotive vehicles, but the same exclusive combination that has enabled Timken Bearings to do what had never been done before in all railroad experience, assures greater dependability and safety; longer life; and lower upkeep costs in passenger cars, trucks, buses and tractors.

That combination is Timken tapered construction, Timken positively aligned rolls and Timken-made steel—the combination that eliminates friction and carries all radial, thrust and combined loads at the same time.

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO

TIMKEN *Tapered Roller* BEARINGS

NEW DEVELOPMENTS

Automotive Parts, Accessories and Production Tools

rule with the accuracy and convenience of a pocket steel tape.

The case is chromium plated. Weight of the 4-ft. "Crescent Junior" complete is but 3 oz., and diameter of case 1¾ in.

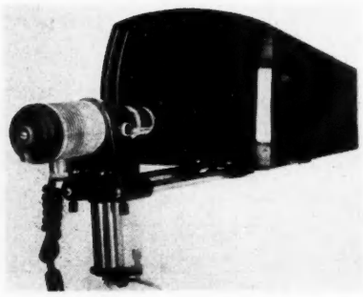
Line of Square Tool Bits

Square tool bits, with the metallurgical features of the regular O. K. line of inserted blade cutters, have been placed on the market by The O. K. Tool Co., Shelton, Conn. The bits are ground to size and will fit any make of square bit tool holders, such as Armstrong, Ready, Western or Williams. They may also be used in the tool holders of turret lathes. There is a variation of but two points in the range of carbon in the steel used—between 68 and 70.

Acro-lite Gage

The "Acro-lite" unit, an attachment for mounting on various kinds of comparators and gaging fixtures, has been placed on the market by the Standard Gage Co., Poughkeepsie, N. Y.

Essentially it is a mechanical projector which throws a large illuminated image of the scale and pointer into the screen of the hood.



In some cases the hood or a special screen may be located on a separate table and the "Acro-lite" mounted on a fixture.

Three scale images give large division readings in 1/10,000, 5/100,000, and 1/100,000th of an inch. The hood is slidably mounted so as to change the size of graduations for any requirements. Scale pieces may be readily changed as desired.

The ease with which the scale may be read and the facility with which pieces may be gaged, cut down the possibility of error and by reducing fatigue insure continued accuracy.

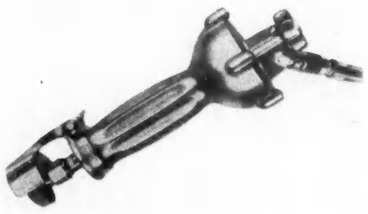
New Stellite Cutters

The new Stellite cutter blade made by The O. K. Tool Co., Shelton, Conn., has been designed to retain the essential features of the O. K. Serrated Cutter Blade, but of suitable construction for Stellite. The blade is backed by an adjustable wedge interlocking with it by mating grooves and positively locking in the body. By changing the position of the grooves of the wedge and blade, the blade may be adjusted either axially or radially, or both, thus allowing for wear both on the outside diameter and face. Assembled together, they will interchange in any other corresponding slot of O. K. Cutters.

Blades are furnished in either Stellite or Stellite J metal. The latter is somewhat stronger and tougher. The new line includes face mills, special drive face mills and end mills.

Madison-Kipp Miracle Air Grinder

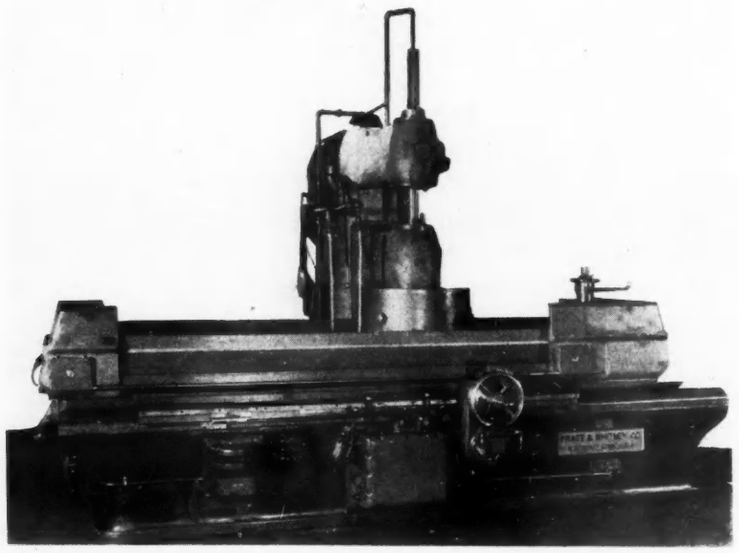
The Miracle air grinder, model DD, operating at 30,000 r.p.m., has been added by the Madison-Kipp Corp., Madison, Wis. It has a wide range



of applications from die work to heavy duty grinding. A variety of special wheels is available, in a total of 41 shapes and sizes and four grades. The tool weighs only 2½ lb. and is 9¾ in. long.

Heavy Duty Hydraulic Vertical Grinder

A new vertical surface grinder known as the 26-in. heavy duty model with hydraulic table drive has just been announced by the Pratt & Whitney Co., Hartford, Conn. The machine without motors weighs 18 tons.



The table working surface is 18 in. by 88 in. with a maximum travel of 104 in. The distance from the table top to a new wheel is 16 in., so there is ample capacity for large work. The hydraulic table drive mechanism with its 10 hp. motor is in back of the bed, out of the way, but all controls are in front. Table speeds range from 30 to 175 ft. per minute, giving far higher grinding speeds than ever were available before. In addition, through the hydraulic drive, any table speed within this range is available instantly by moving a lever on a graduated speed chart.